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The Øresund experiment. Data bank report

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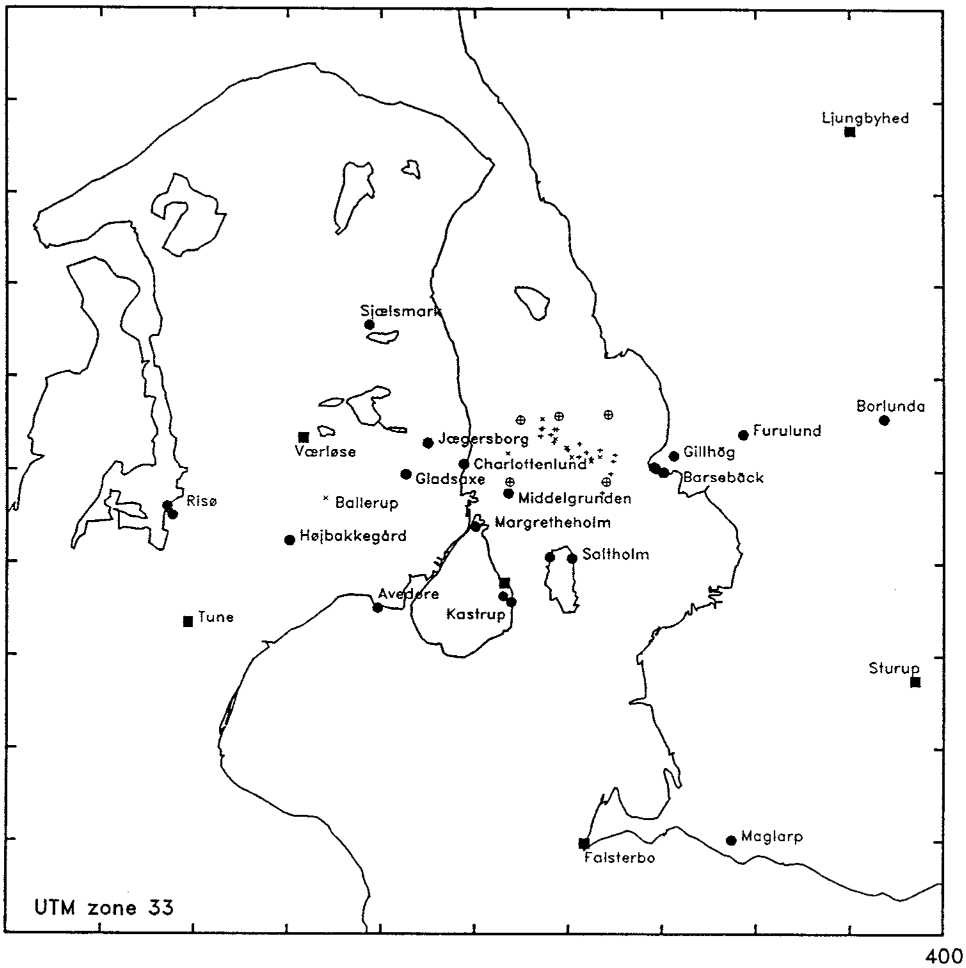
The Øresund Experiment Data Bank Report

Niels G. Mortensen and Sven-Erik Gryning



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December 1989

Abstract The present report supplements and extends a previously published magnetic tape containing the complete documented data set of the Øresund Experiment (Gryning, Bull. Amer. Meteor. Soc., 66(1985), 1403-1407). The report and the tape together constitute the *Øresund Experiment Data Bank.*

The report contains information not readily mapped into the data bank formatting scheme (GF-3), e.g. weather maps from each day of the experiment and satellite images from days with tracer experiments. Furthermore, the report presents an overview of the Øresund Experiment in tables and graphs, and in this way also serves as a key to the data bank. The general meteorological conditions during the experiment are revealed through time-series plots of selected meteorological parameters. Displaced-profiles plots of sodar-measured wind speeds and radiosonde potential temperatures give evidence on the structure of the atmospheric boundary layer. Finally, each of the 9 tracer experiments is illustrated by a map of the experimental setup and graphs of the tracer concentration profiles measured along chains of ground-based stations.

In addition to the meteorological information the report provides an introduction to the GF-3 formatting system and summarizes the conventions applied in compiling the data bank. An overview of the contents of the data bank tape is also given.

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Preface and acknowledgements

The main objective of the Øresund Experiment (Gryning, 1985) was to obtain a comprehensive data set suitable for verifying mesoscale meteorological and dispersion models in a coastal environment. Furthermore, it was a project goal to make these data available for general use. Hence, the establishment of a data bank for the experiment was included in the project.

The final version of the data bank was released in 1987 (Mortensen, 1987) and was the first version to be available to scientists and institutions 'outside' the Øresund experiment. It consists of a magnetic tape containing the full set of quality controlled and documented data of the experiment, see Appendix C.

The present report contains information not readily mapped into the data bank formatting scheme, e.g. weather maps from each day of the experiment and satellite images from days with tracer experiments. Furthermore, the report presents an overview of the experiment in tables and graphs, and in this way also serves as a key to the data bank. The general meteorological conditions during the experiment are revealed through time-series plots of selected meteorological parameters. Displaced profile plots of sodar-measured wind speeds and radiosonde potential temperatures give evidence on the structure of the atmospheric boundary layer. Finally, each of the 9 tracer experiments is illustrated by a map of the experimental set-up and graphs of the tracer concentration profiles measured along chains of ground-based stations.

The planning of the Øresund Experiment was carried out by institutions from the Nordic countries with NORDFORSK (Nordic Cooperative Organization for Applied Research) acting as project coordinator. The authors especially want to thank Mari-Mai Lagus of the now abolished NORDFORSK for her excellent handling of the project. The participants of the experiment are acknowledged for their support and prompt reactions during the establishment of the data bank.

Siegfried Vogt, Kernforschungszentrum Karlsruhe, first pointed out to us the existence of the GF-3 data bank formatting scheme. He further provided us with the connection to W. Gloeden and M. Penzhorn of the Deutscher Wetterdienst, Seewetteramt Hamburg, who convinced us that the GF-3 scheme could indeed be applied to the Øresund data set. Furthermore, they shared with us their experience in working with GF-3 and also provided a sample GF-3 tape and documentation.

During the process of establishing the data bank Meirion T. Jones and R.K. Lowry, Marine Information and Advisory Service (MIAS) in UK, provided valuable information on GF-3 and its use. Their comments on a draft version of the data bank tape are also gratefully acknowledged. H. Dooley, International Council for the Exploration of the Sea (ICES) in Copenhagen, supplied further information on GF-3 as well as the GF-3 manuals and guides.

Svend Erik Jensen and Søren Hansen, Royal Veterinary and Agricultural University of Denmark, are acknowledged for permission to incorporate data from the agro-meteorological station Højbakkegård in the data bank.

The weather maps presented in Chapter 5 are reproduced from "Europäischer Wetterbericht" with the permission of the Deutscher Wetterdienst. The satellite images in Chapter 6 were kindly furnished by Torben Rye Nielsen, Observatory for Space Research, Danish Meteorological Institute.

The technical reports mentioned in Section 6, together with the data bank tape and the present report constitute the complete technical documentation of the Øresund Experiment. The publishing of this report therefore concludes the Øresund Experiment proper.

1 The Øresund Experiment

The Øresund Experiment was an international project with the purpose of investigating the nature of turbulence and atmospheric dispersion over a land-water-land area. The main objective was to obtain a comprehensive data set suitable for verifying mesoscale meteorological and dispersion models in a coastal environment. The experiment was carried out over the 20-km-wide strait of Øresund between Denmark and Sweden. The meteorological observational network extended over an 80-km-wide cross-section through Øresund and a large proportion of the available micro- and meso-meteorological instrumentation in the Nordic countries was employed. In addition, considerable contributions were made by non-Nordic countries.

The dispersion process was investigated by SF_6 tracer experiments and by tetroon flights. The tracer measurements comprised time-averaged concentrations at several fixed positions in an arc-like set-up, and instantaneous concentrations from a van, a boat and an aircraft. Emphasis was put on conditions when the water was colder than the surrounding land-areas, which in the experimental period typically occurred during daytime.

The experiment took place in the period May 15 to June 14, 1984. A special intensive measuring program was carried out from June 4–10. The experiment was a joint effort of 15 institutions situated in the Nordic countries (Denmark, Finland, Norway and Sweden) as well as in Belgium, the Federal Republic of Germany and the Netherlands:

Denmark

Risø National Laboratory (RISØ)[1]
Air Pollution Laboratory, Nat. Agency of Environmental Protection (APL)[2]
Danish Meteorological Institute (DMI)

Finland

Finnish Meteorological Institute (FMI)
Institute of Marine Research (IMR)

Norway

Norwegian Institute for Air Research (NILU)

Sweden

Department of Meteorology, University of Uppsala (MIUU)
Swedish Meteorological and Hydrological Institute (SMHI)
Chalmers University of Technology (CUT)
National Defense Research Institute (FOA)
Studsvik Energiteknik AB (STU)

Belgium

Studiecentrum voor Kernenergie (SCK)

Germany (FRG)

Kernforschungszentrum Karlsruhe (KFK)

The Netherlands

Vrije Universiteit (VU)

In addition, the Royal Veterinary and Agricultural University of Denmark (KVL) contributed measurements to the experiment.

An overview of the Øresund Experiment is given in Gryning (1985). Descriptions of the practical and technical implementation of the experiment, as well as an appraisal of the experimental techniques employed, are given in a series of technical reports, see Section 6.

[1]The acronyms shown in brackets after each institution are used throughout the report for reference.
[2]From January 1, 1989: Division of Emission and Air Pollution, National Environmental Research Institute.

2 The Data Bank

The main objective of the Øresund Experiment was to obtain a comprehensive data set suitable for verifying mesoscale models. It was a project goal to make these data available for general use. Hence, the establishment of a data bank for the experiment was included in the project. The following sections give a brief overview of the data bank now established and mentions some of the salient features of the data formatting system.

2.1 The GF-3 system

The data set of the Øresund Experiment has been compiled on magnetic tape according to the IOC general magnetic tape format (GF-3). This format scheme was devised for international exchange of geophysical data, primarily of numerical nature. An introductory guide, as well as the complete technical specification of the system, is available from the Intergovernmental Oceanographic Commission, see Appendix C. The GF-3 system has the following general characteristics (IOC, 1987):

1. The format consists of rather simple structures so that it can be used by single scientist and small institutions, as well as large data centers.
2. The format is largely self-documenting and self-describing through the provision of plain language comment capabilities at all levels of the structure and through inclusion of formatting information and character coding information on the tape.
3. The format is capable of being processed automatically by the recipient of the tape.
4. The structures of the format are capable of transmitting complex multidisciplinary data sets, as well as the most simple sets.
5. The format is a magnetic tape format for the exchange of data and is in many cases suitable for archiving of these data.

A major feature of the GF-3 format system is the fact that a GF-3 tape is self-contained. All the information necessary to interpret and understand the contents of the tape and to retrieve the data, is included on the tape itself. Thus, to process a GF-3 tape only the density and character code of the tape need to be known in advance – and the fact that the tape is in GF-3 format.

The basic element of GF-3 is the logical GF-3 record, corresponding to a fixed-size physical record or block. GF-3 records contain 1920 characters and may be thought of as one 'screen' af data (24 lines × 80 characters). In the hierarchical structure of GF-3 the *records* are organized into *series*. One or more series constitute a *file* and the files are organized into one or several *tapes*. Figure 1 illustrates the rules applied for the sequencing of GF-3 records in the Øresund Experiment Data Bank. The GF-3 records of a sample data bank file are listed in Appendix B.

The table of contents of the Øresund Data Bank on the file level of the tape is shown in Figures 2 and 3. Four types of files are recognized by GF-3:

- Test File (file ID 001 in Figure 2)
- Tape Header File (002)
- Data Files (from 003 through 212)
- Tape Terminator File (480)

These files must be arranged on the tape according to Figure 1.

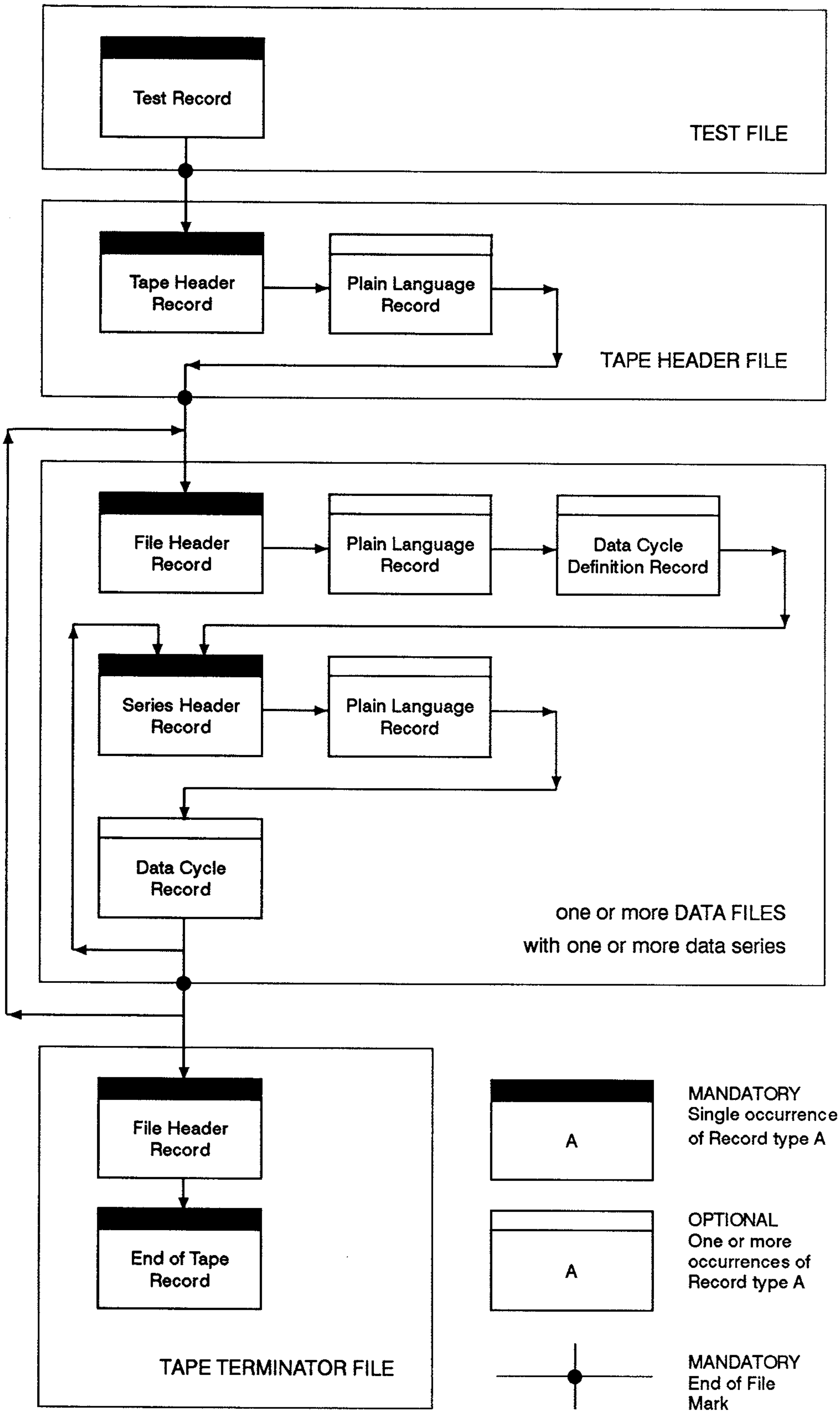


Figure 1. Schematic diagram to illustrate the sequencing of records in the Øresund Experiment data bank. The files on the tape are separated by End-of-File marks and the last file on the tape is ended by two EOF marks.
Notice, that the tape structure shown above is a subset of GF3. The record types and the rules for sequencing records on a GF3 tape in general are more comprehensive – the tape structure may therefore be more complicated (IOC, 1987).

001-009	GENERAL		1	2	3	4	5	6	7	8	9
001	Test file	RISØ	•	•	•	•	•	•	•	•	•
002	Tape Header File	RISØ	•	•	•	•	•	•	•	•	•
003	Map of the Øresund region	RISØ	•	•	•	•	•	•	•	•	•
004	Table of scan-times	RISØ	•	•	•	•	•	•	•	•	•

010-039	MAST AND ENERGY BALANCE		1	2	3	4	5	6	7	8	9
019	Risø, small mast	RISØ	•	•	•	•	•	•	•	•	•
020	Risø, tower	RISØ	•	•	•	•	•	•	•	•	•
021	Højbakkegård	KVL	•	•	•	•	•	•	•	•	•
022	Sjælsmark	RISØ	•	•	•	•	•	•	•	•	•
023	Avedøre	RISØ	•	•	•	•	•	•	•	•	•
024	Charlottenlund	FMI	•	•	•	•	•	•	•	•	•
025	Margretheholm	RISØ	•	•	•	•	•	•	•	•	•
026	Saltholm W	MIUU	•	•	•	•	•	•	•	•	•
027	Saltholm E	RISØ	•	•	•	•	•	•	•	•	•
028	R/V Aranda (Øresund)	IMR	–	–	–	–	–	•	•	•	–
029	Barsebäck, beach 1	VU	•	•	•	•	•	•	•	•	•
030	Barsebäck, beach 2	VU	•	•	•	•	•	•	•	•	•
031	Barsebäck, beach 3	MIUU	•	•	•	•	•	•	•	•	•
032	Barsebäck, tower	MIUU	•	•	•	•	•	•	•	•	•
033	Maglarp	SMHI	•	•	•	•	•	•	•	•	•
034	Furulund	SMHI	•	•	•	•	•	•	•	•	•

040-059	SODAR MEASUREMENTS		1	2	3	4	5	6	7	8	9
040	Gladsakse	MIUU	•	•	•	•	•	•	•	•	•
041	Middelgrunden	SMHI	•	•	•	•	•	•	•	•	•
042	Kastrup	MIUU	•	•	•	•	•	•	•	•	•
050	Barsebäck	FOA	•	•	•	•	•	•	•	•	•
051	Furulund	STU	•	•	•	•	•	•	•	•	•
052	Borlunda	SMHI	–	•	–	•	•	•	•	•	•

060-079	RADIOSONDE MEASUREMENTS		1	2	3	4	5	6	7	8	9
060	Ballerup, mini-sondes	NILU	–	–	–	–	–	–	•	•	–
061	Jægersborg: radiosondes	DMI	•	•	•	•	•	•	•	•	•
062	Øresund: mini-sonde	RISØ	•	–	–	–	•	–	•	–	•
063	Øresund: Sprenger sondes	SMHI	–	–	–	–	•	–	•	–	–
070	Borlunda: radiosondes	SMHI	•	•	•	•	•	•	•	•	•

080-099	BALLOON MEASUREMENTS		1	2	3	4	5	6	7	8	9
080	Charlottenlund: tethered balloon	FMI	–	–	–	–	–	–	–	•	–
090	Barsebäck: tetroon flights	KFK	–	–	–	–	–	–	•	•	–
091	Barsebäck: tethered balloon	MIUU	–	–	–	•	•	•	•	•	•
092	Barsebäck: pilot balloon	MIUU	–	–	–	–	–	–	•	–	•

100-119	TURBULENCE MEASUREMENTS		1	2	3	4	5	6	7	8	9
100	Gladsakse: fast scanning	RISØ	•	–	•	–	•	–	•	–	•
101	Gladsakse: mean quantities	RISØ	•	–	•	–	•	–	•	–	•
110	Barsebäck: fast scanning	MIUU	•	•	•	•	•	•	•	•	•
111	Barsebäck: mean quantities	MIUU	•	•	•	•	•	•	•	•	•

120-139	METEOROLOGICAL OBSERVATIONS		1	2	3	4	5	6	7	8	9
120	Kastrup: METAR observations	RISØ	•	•	•	•	•	•	•	•	•
121	Denmark: synoptic pressure obs.	APL	•	•	•	•	•	•	•	•	•
130	Sweden: synoptic observations	SMHI	•	•	•	•	•	•	•	•	•

Figure 2. Contents of the Øresund Experiment Data Bank (I). Dots indicate availability of data in the specified period 1–9, see Fig. 4; a minus sign indicates that data were not collected.

140-159	MISCELLANEOUS METEOROLOGY		1	2	3	4	5	6	7	8	9
140	Charlottenlund (intensive)	FMI	•	•	•	–	–	–	•	•	–
148	Øresund: marine met. obs.	SMHI	•	•	•	•	•	•	•	•	•
149	Øresund: airplane measurements	NILU	–	–	–	–	•	–	•	–	•
150	Borlunda: TPR temp. profiles	CUT	–	–	–	•	•	•	•	•	•
151	Borlunda: TPR brightness temp.	CUT	–	–	–	•	•	•	•	•	•
152	Borlunda: ground level obs.	CUT	–	–	–	•	•	•	•	•	•

200-219	TRACER MEASUREMENTS		1	2	3	4	5	6	7	8	9
200	Time averaged: APL,SCK,NILU		•	–	•	–	•	–	•	–	•
201	1-hour: derived quant.		•	–	•	–	•	–	•	–	•
202	20-min: derived quant.		•	–	•	–	•	–	•	–	•
210	Instantaneous: van	SCK	•	–	•	–	•	–	•	–	•
211	airplane	NILU	–	–	–	–	•	–	•	–	•
212	fishing boat	NILU	–	–	–	–	–	–	•	–	–

480-499	GENERAL		1	2	3	4	5	6	7	8	9
480	End of tape file	RISØ	•	•	•	•	•	•	•	•	•

Figure 3. Contents of the Øresund Experiment Data Bank (II). Dots indicate availability of data in the specified period 1–9, see Fig. 4; a minus sign indicates that data were not collected.

Test File

The primary purpose of the Test File is to protect against data loss, should the leading portion of the tape be damaged. It consists of several GF-3 records each containing 1920 occurrences of the character 'A'.

Tape Header File

The Tape Header File contains character coding information and other information pertaining to the tape as a whole, e.g. the originating data centre, the version of GF-3 used and tape identification. On the Øresund tape this file further contains a table of contents of the tape, a complete list of the GF-3 codes used on the tape, a list of the conventions of time, position etc. used, references to the format and some general publications on the Øresund Experiment and bibliographical information.

Data files

The Data Files contain the experimental data. One Data File generally contains the measurements at a certain site with a specific measuring system or from a specific platform. Each file is constructed using the record types provided by GF-3 and it is divided in two parts: a file header part and the data. The header part of the file contains information on the data-collecting institution and when, where and how the data were collected. Reference to a technical report describing details of the measurements, as well as reference to other data files and/or reports relevant to the interpretation of the data in question are also given here. Furthermore, this part of the data file may contain tables summarizing the measurements or tables of derived quantities calculated by the data-collecting institution. For each type of measurement in the file a description of the instrument used, its characteristics and the expected accuracy is always given. Immediately preceeding the data series, a *Fortran* format statement to read the data is listed together with a short definition of the data parameters and the dummy values to be expected in the data. The hierarchy of the data file and the capability of reading the format statement means that any data file can be read and the data retrieved by a relatively simple general program.

The plain language documentation included in the data files amount to almost 200 pages in total, i.e. 3–4 pages in each data file. Data are stored as integer values in the data records of the file. The integers are converted to the physical values when reading the data, by scaling factors provided in the file header part. Data are arranged in a tabular format to enhance legibility when printed on paper.

The last file on the tape is the Tape Terminator File indicating whether the data set is complete or continued on another tape.

Tape Terminator File

2.2 Compilation of the data bank

The compilation of the Øresund Experiment Data Bank was performed at Risø National Laboratory and comprised the following tasks:

Collection of raw data

The raw (measured) data were transferred from the data-collecting institutions to Risø in a variety of ways: on magnetic tape, on floppy disk, in writing, by phone etc. The data were subsequently read or typed into Risø's main Burroughs computer.

Reduction of raw data

During or after the transfer, the raw data were reduced to a common system of reference. The different conventions and specifications used by the data-collecting institutions with respect to time, place, bearing, physical units, 'dummy' values etc., were reduced to one common system. Data of the same general type, e.g. time-series data from meteorological masts, were also brought into a common format and padded with dummy values if the series was not complete.

Inspection of raw data

It was the responsibility of each data-collecting institution to check their data for errors and inconsistencies before handing them over to Risø. However, most of the data were checked again during the data reduction. This inspection was mostly restricted to checking the sign, range, magnitude etc. of the raw data. Most data were also plotted as time-series, profiles or other types of graphs for visual inspection. The data inspection revealed few errors only and these were subsequently corrected – or the data recalibrated – in agreement with the institution in question.

Addition of general information

In addition to processing the measured data, the data centre at Risø compiled some general information to be included in the data bank: a digital map of the Øresund region, coordinates to all sites, lists of institutions/contact persons, references etc. The plain language text, to accompany the data on the final tape, was written on basis of the information supplied by the data-collecting institutions.

Formatting data and information

Finally, the processed data and textual information was formatted into GF-3 files according to the rules shown in Fig. 1. These files are stored permanently on disk in Risø's computer from where they may be copied to produce a data bank tape. Hence, the Øresund Experiment Data Bank consists of one 3600-ft, 1600-bpi magnetic tape in GF-3.2 format containing the complete data set, see Fig. 2 and 3. The character coding may be ASCII or EBCDIC according to the wish of the recipient.

The data bank proper covers the entire experimental period. However, data are also available for shorter periods of time. Data banks for the 9 sub-periods listed in Fig. 4, the sum of which makes up the entire period, has been established as well. The tape structure and textual information are the same, but the data parts of the files are limited to the time period in question.

The data bank tape mentioned above contains the complete data set – including 10-min and 1-hour statistics calculated from the turbulence measurements – and is referred to as the Øresund Experiment Data Bank. The original 1-Hz and 0.1 Hz turbulence measurements, however, have also been formatted into GF-3. These data are available upon request as separate data bank tapes.

Copying and distribution

The GF-3 tape, Fortran programs to process it, and some written documentation has been collected into a data bank 'package' which is copied and distributed by Risø on a non-profit basis to interested scientists and institutions, see Appendix C.

Period	Starting	Ending	Tracer experiments
1	May 15	May 18	2 tracer experiments
2	May 19	May 21	
3	May 22	May 22	1 tracer experiment
4	May 23	May 28	
5	May 29	May 30	2 tracer experiments
6	May 31	June 3	
7	June 4	June 5	2 tracer experiments
8	June 6	June 11	
9	June 12	June 14	2 tracer experiments

Figure 4. Data bank tapes are also available for the 9 sub-periods indicated above.

2.3 Conventions

The following conventions are used throughout the data bank tape and in this report:

Time

All indications of time are given in Central European Time (CET), which is the standard (zonal) time of Denmark and Sweden. The relation between CET and Greenwich Mean Time (GMT, equals UTC) is CET = GMT + 1 hour. The difference between standard (zonal) and local (sun) time is on the order of 10 min.

Place

Positions are given in geographical latitude/longitude and/or Universal Transverse Mercator (UTM) Northing/Easting in metres, both referenced to European Datum 1950 (ED 50). UTM-coordinates are preferred whenever possible. Transformation between the two systems has been performed in accordance with the Danish Geodetic Survey[3].

Direction

Bearings (e.g. wind direction) can be referred to geographic, magnetic or grid (UTM) north. The isogon for 0 deg magnetic declination runs approximately North-South through Øresund and the declination for any location is within 0 ± 0.5 deg. Consequently, the bearings listed by the data suppliers – whether referred to true or magnetic north – have been transferred to the data bank without transformation. No bearings in the data bank have been referenced to grid north.

Physical units and dummy values

The SI system of physical units is used throughout the data bank. Appendix A provides a list of the different parameters occurring in the data bank, their GF-3 code (IOC, 1987) and physical units. The dummy values used to indicate missing data appears from the Data Cycle Definition Records – an example is given in Appendix B.

2.4 Limitations

The GF-3 files of the Øresund Experiment Data Bank were formatted with Fortran-77 programs written at Risø. Since the establishment of the data bank, a general purpose software package – GF3-Proc – for reading and writing data formatted according to the GF-3 system has become available. Due to a misinterpretation at Risø of the intentions build into GF-3, it is *not* possible to process version 2.0 of the Øresund Experiment Data Bank using the GF3-Proc software package (Lowry, 1987, pers. comm.). This limitation has not caused problems for users of the data bank so far.

[3]Andersson, O. and K. Poder (1981). Coordinate transformations at the Geodetic Survey. In Danish. Landinspektøren, August 1981, 552–571.

3 Meteorological measurements

The meteorological part of the experiment consisted of obtaining information on the flow field and ground level conditions along an 80-km-long traverse passing through the Øresund. With the wind blowing from either a westerly or an easterly direction, this experimental set-up provided information on the meteorology of several characteristic areas: the 'undisturbed' flow over land upwind from the coast, the flow transition over the water surface, and the conditions downwind from the Øresund. The abrupt changes at the upwind and downwind coastlines, where internal boundary layers develop, are also documented.

The sites where the meteorological measurements were carried out are listed below in Fig. 5 and shown in Fig. 6.

Locality	Northing [m]	Easting [m]	Latitude N	Longitude E	Elevation [m] a.s.l.
Denmark:					
Risø (tower)	6176090	317070	55° 41′ 41.4″	12° 05′ 22.2″	6.5
Risø (small mast)	6175140	317620	55° 41′ 11.4″	12° 05′ 55.9″	8.5
Højbakkegård	6172422	330175	55° 40′ 00.0″	12° 18′ 00.0″	30.0
Sjælsmark	6195650	338670	55° 52′ 41.0″	12° 25′ 16.2″	30.0
Avedøre	6165180	339580	55° 36′ 17.5″	12° 27′ 12.9″	2.0
Gladsaxe	6179610	342590	55° 44′ 07.3″	12° 29′ 34.9″	45.0
Charlottenlund	6180750	348770	55° 44′ 51.3″	12° 35′ 26.6″	2.0
Jægersborg	6182980	344940	55° 45′ 59.0″	12° 31′ 42.6″	40.0
Margretheholm	6173980	350020	55° 41′ 13.9″	12° 36′ 51.6″	3.0
Kastrup (sodar)	6165840	353830	55° 36′ 55.0″	12° 40′ 45.2″	2.0
Kastrup (METAR)	6166470	352990	55° 37′ 14.4″	12° 39′ 56.0″	2.0
Middelgrunden	6177600	353550	55° 43′ 14.7″	12° 40′ 06.6″	7.0
Saltholm W	6170700	357970	55° 39′ 36.5″	12° 44′ 32.5″	1.0
Saltholm E	6170560	360330	55° 39′ 34.4″	12° 46′ 47.7″	1.0
Sweden:					
Barsebäck (tower)	6179910	370130	55° 44′ 46.4″	12° 55′ 52.1″	5.0
Barsebäck 1	6180350	369130	55° 44′ 59.7″	12° 54′ 54.1″	0.0
Barsebäck 2	6180465	369040	55° 45′ 03.3″	12° 54′ 48.7″	1.0
Gillhög	6181670	371200	55° 45′ 44.3″	12° 56′ 50.5″	25.0
Furulund	6183960	378620	55° 47′ 05.3″	13° 03′ 52.2″	25.0
Maglarp	6140110	377400	55° 23′ 26.6″	13° 03′ 52.4″	15.0
Borlunda	6185640	393650	55° 48′ 12.3″	13° 18′ 12.2″	50.0

Figure 5. Positions where meteorological measurements were carried out during the Øresund Experiment. UTM Northing and Easting refer to UTM Zone 33. Elevation is above mean sea level.

A wide variety of meteorological instrumentation was employed in the experiment. An overview of the meteorological measuring program is given in Sections 3.1–3.6, which also illustrate some overall characteristics of the weather conditions during the experiment. Furthermore, a key is provided to the tecnical reports describing the instrumentation in detail, see also the *References* section (page 101).

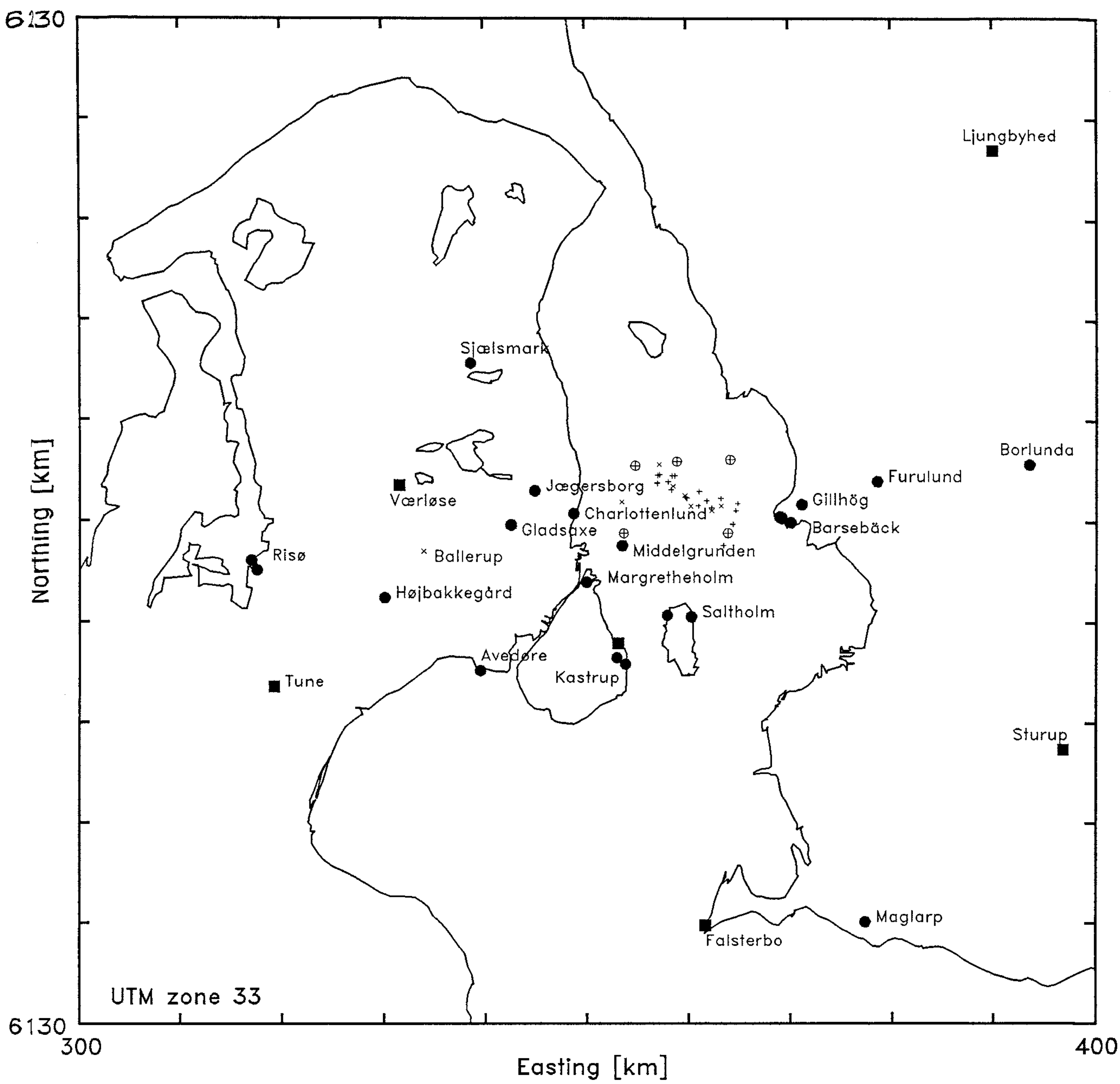


Figure 6. Map of the Øresund region showing the meteorological measuring sites of the experiment, see Fig. 5. Squares mark synoptic stations; these are not included in Fig. 5. Circles with crosses are the positions of R/V Aranda. Mini-sonde launch sites are also indicated (+ and ×). The map, frame and positions are included in the data bank (file ID 003).

3.1 Masts and energy-balance

Meteorological measurements from masts and towers were carried out at 15 localities. In addition, comprehensive surface energy balance measurements were made at one station. The measurements at these 16 localities are described in detail in the following technical reports (see Section 6):

Small masts

019	Risø	Gryning and Mortensen (1986)
022	Sjælsmark	Gryning and Mortensen (1986)
023	Avedøre	Gryning and Mortensen (1986)
024	Charlottenlund	Tammelin (1986)
025	Margretheholm	Gryning and Mortensen (1986)
026	Saltholm W	Smedman and Melas (1986)
027	Saltholm E	Gryning and Mortensen (1986)
028	R/V Aranda	Launiainen *et al.* (1987)
029	Barsebäck 1	Vugts and Cannemeier (1986)
030	Barsebäck 2	Vugts and Cannemeier (1986)
031	Barsebäck 3	Smedman and Melas (1986)
034	Furulund	Ericson (1986)

Tall masts

020	Risø	Gryning and Mortensen (1986)
032	Barsebäck	Smedman and Melas (1986)
033	Maglarp	Ericson (1986)

Energy balance

021	Højbakkegård	Hansen *et al.* (1981)

The positions of the masts and towers are given in Fig. 5 and shown on the map of the Øresund region, Fig. 6. The instrumentation of each mast and the energy balance station appears from Fig. 7.

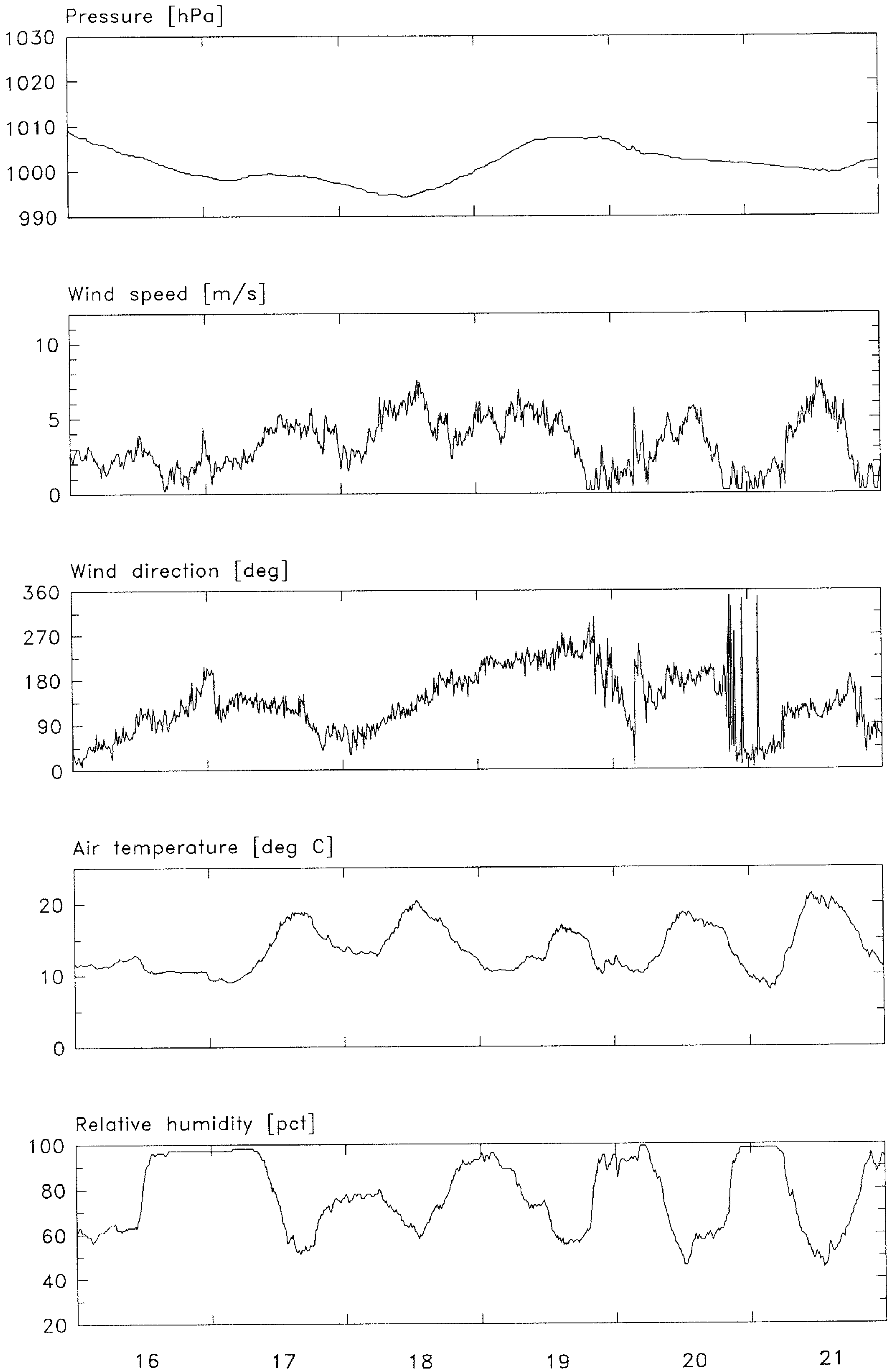
The general weather conditions during the experiment are revealed in Figs. 8–12 through time-series plots of 9 different meteorological variables. For this purpose two mast were selected: the 10-m mast at Sjælsmark (left-hand pages) and the station at Risø (right-hand pages).

Atmospheric pressure, wind speed and direction, air temperature and relative humidity were measured without interruption at the Sjælsmark mast – 8 km W of the Danish coast of Øresund. The mast is situated in a fairly homogeneous military training area. The surface consists mostly of long grass, but with some bare areas (wheel tracks etc) and the mast is well exposed.

Incoming short-wave radiation – on an area perpendicular to the rays of the sun and on a horizontal area – as well as net radiation and precipitation were measured at Risø, which is situated in the westernmost part of the experimental area.

Station name and ID		Max. observation height [m]	Wind speed (horizontal)	Wind speed (3-D)	Wind direction	Gust wind speed	Std. dev. wind speed	Std. dev. wind direction	Temperature	Temperature gradient	Wet-bulb temperature	Dew-point temperature	Soil/sea temperature	Relative humidity	Precipitation	Atmospheric pressure	Short-wave direct	Short-wave incoming	Short-wave diffuse	Short-wave outgoing	Long-wave outgoing	UV radiation	IR radiation	Net radiation	Soil heat flux
Risø Mast	019	33	4	–	3	–	–	–	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Risø Tower	020	117	5	–	4	–	–	3	5	–	–	–	–	–	1	1	1	1	–	–	–	–	–	1	–
Højbakkegård	021	2	1	–	1	–	–	–	1	–	–	1	1	–	–	–	–	1	1	1	1	1	1	1	1
Sjælsmark	022	10	2	–	1	–	–	–	2	1	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–
Avedøre	023	32	8	–	2	1	–	–	3	4	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–
Charlottenlund	024	13	5	1	1	–	5	1	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Margretheholm	025	39	1	–	1	–	–	–	2	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Saltholm West	026	23	5	–	1	–	–	–	5	–	2	–	–	–	–	–	–	–	–	–	–	–	–	1	–
Saltholm East	027	10	2	–	2	–	–	–	2	1	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–
R/V Aranda	028	11	1	–	1	1	–	–	2	–	1	–	2	–	–	–	–	–	–	–	–	–	–	–	–
Barsebäck Mast 1	029	24	6	–	–	–	–	–	5	–	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Barsebäck Mast 2	030	24	6	–	–	–	–	–	5	–	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Barsebäck Mast 3	031	12	4	–	1	–	–	–	3	–	1	–	1	–	–	–	–	–	–	–	–	–	–	1	–
Barsebäck Tower	032	95	6	–	2	–	–	–	6	–	3	–	–	–	1	1	–	1	–	–	–	–	–	1	–
Maglarp	033	120	7	–	3	–	–	–	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Furulund	034	18	4	–	1	–	4	–	4	–	–	–	–	–	–	1	–	1	–	–	–	–	–	1	–

Figure 7. Instrumentation of the masts. The table shows the number of measurement levels of each meteorological parameter.


Pressure [hPa]
1030
1020
1010
1000
990
Wind speed [m/s]
10
5
0
Wind direction [deg]
360
270
180
90
0
Air temperature [deg C]
20
10
0
Relative humidity [pct]
100
80
60
40
20
16
17
18
19
20
21

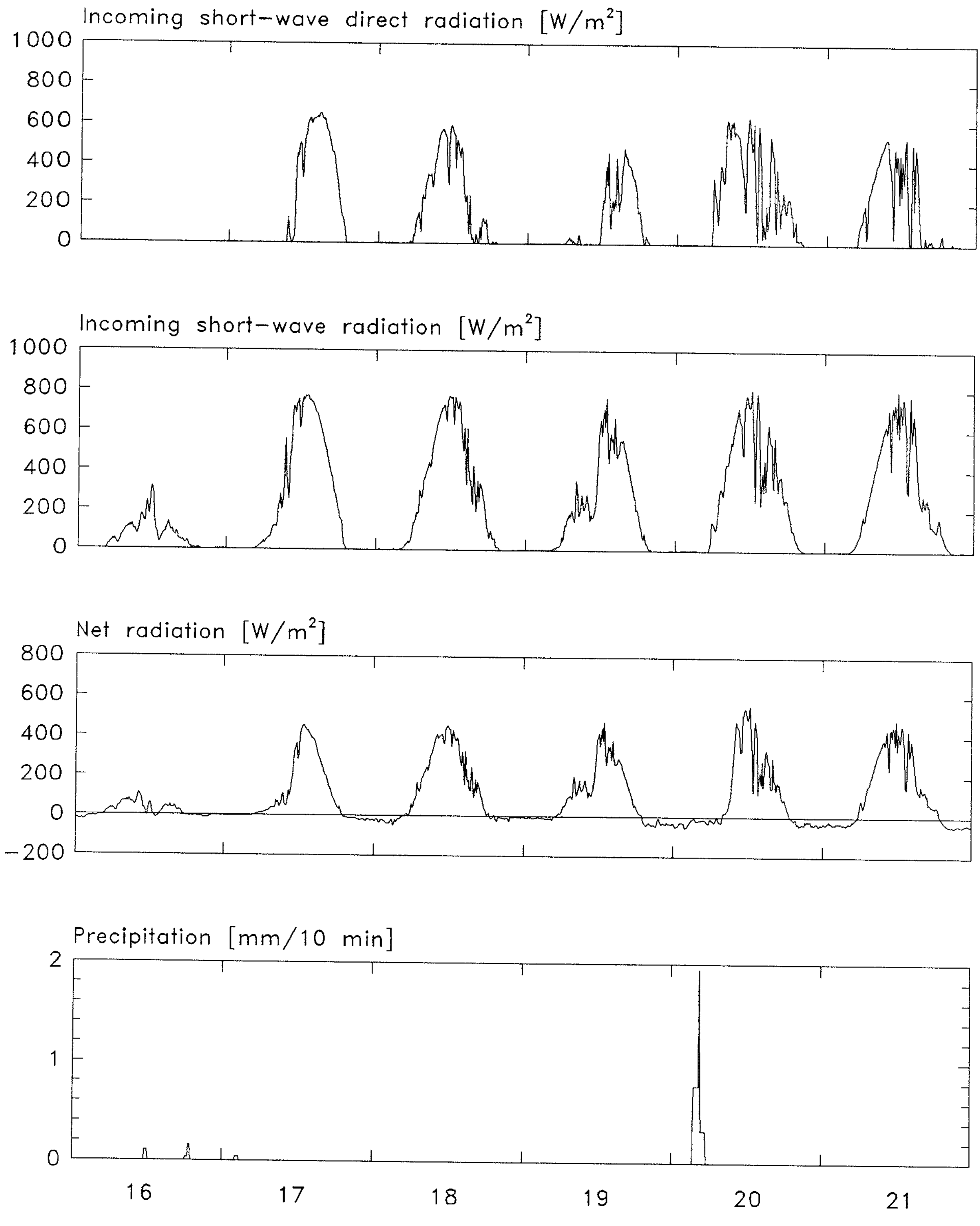
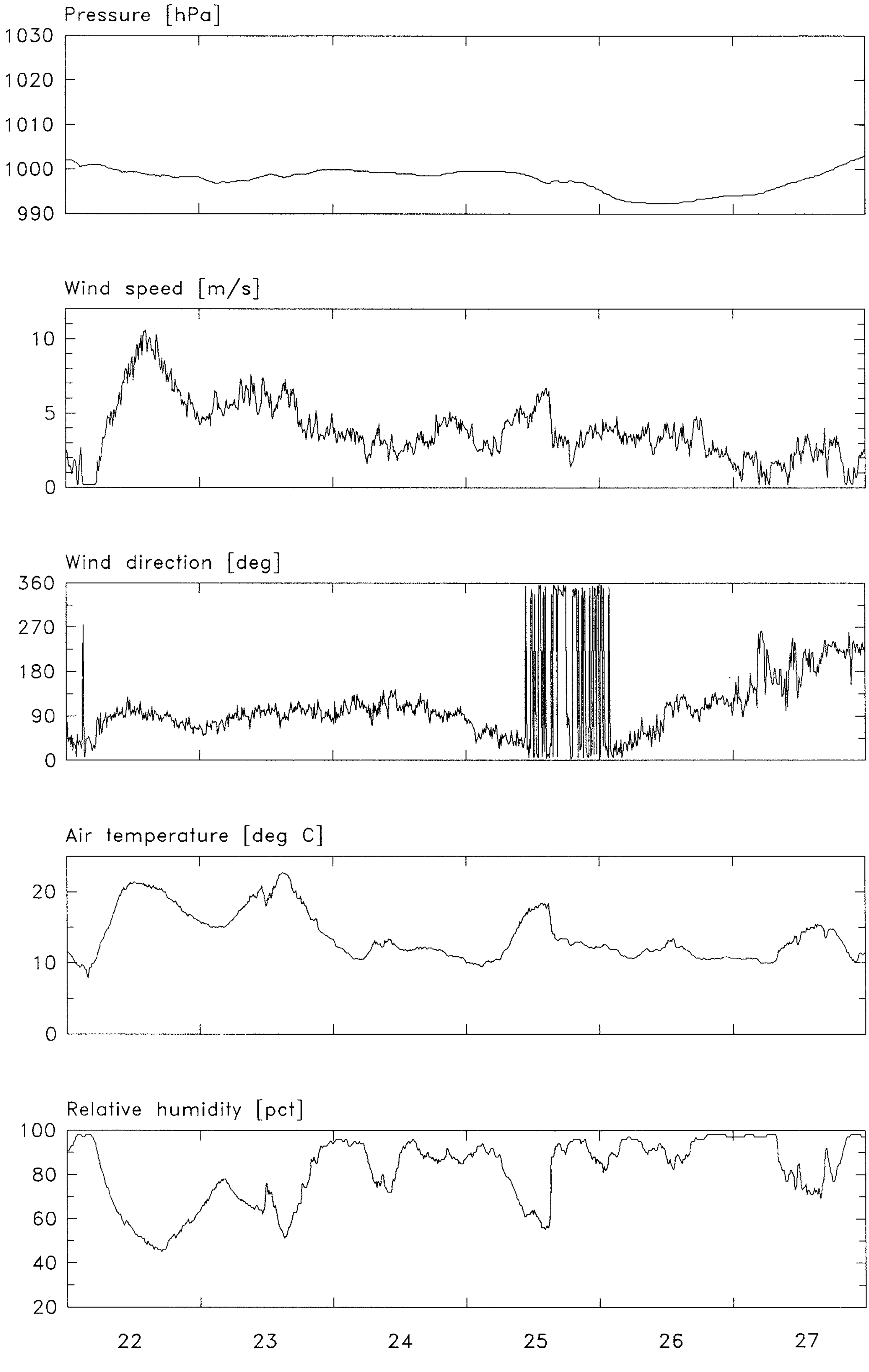


Figure 8. General weather conditions May 16–21, revealed by measurements at the Sjælsmark mast (opposite page) and at the Risø tower (above).


Pressure [hPa]
1030
1020
1010
1000
990
Wind speed [m/s]
10
5
0
Wind direction [deg]
360
270
180
90
0
Air temperature [deg C]
20
10
0
Relative humidity [pct]
100
80
60
40
20
22
23
24
25
26
27

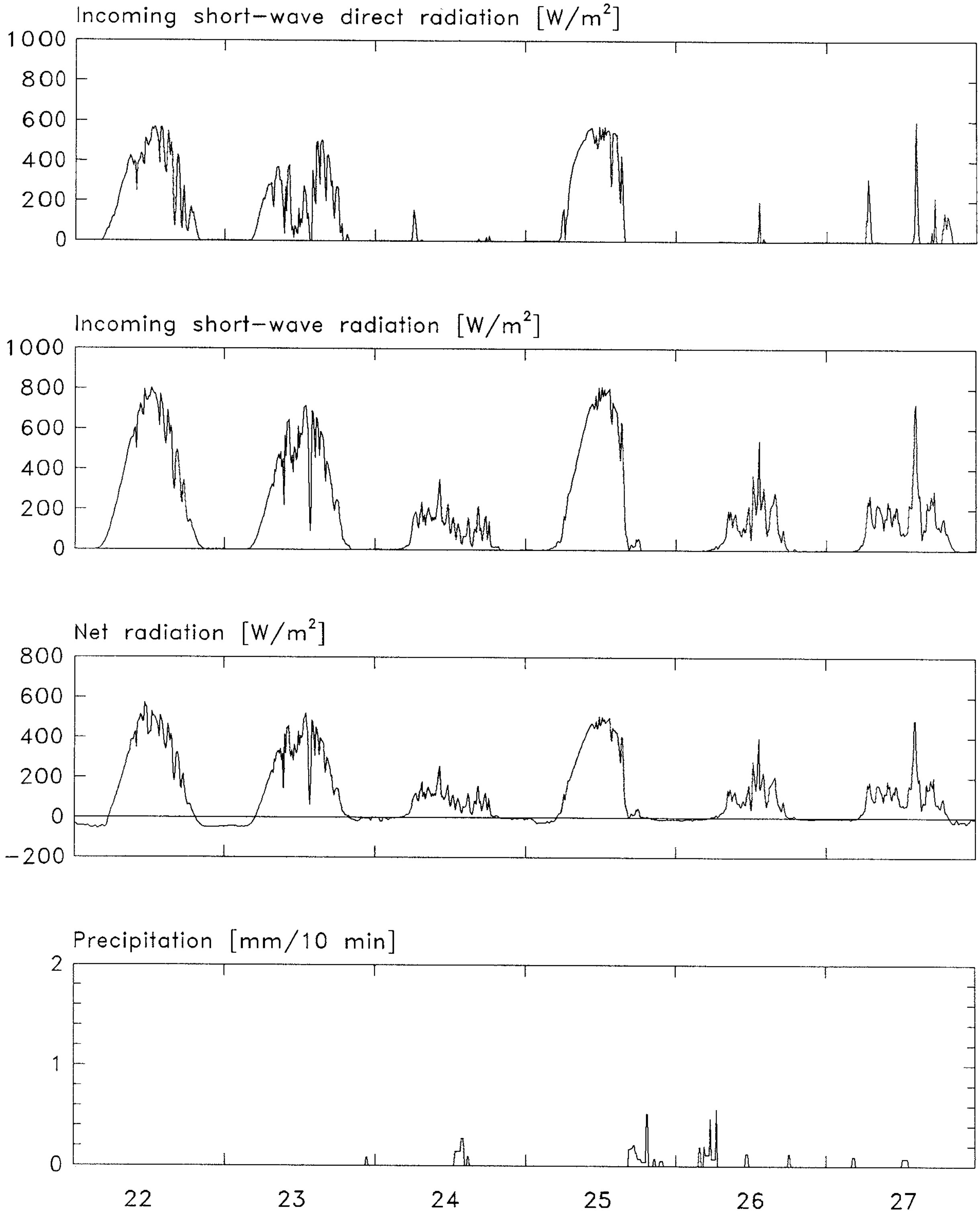
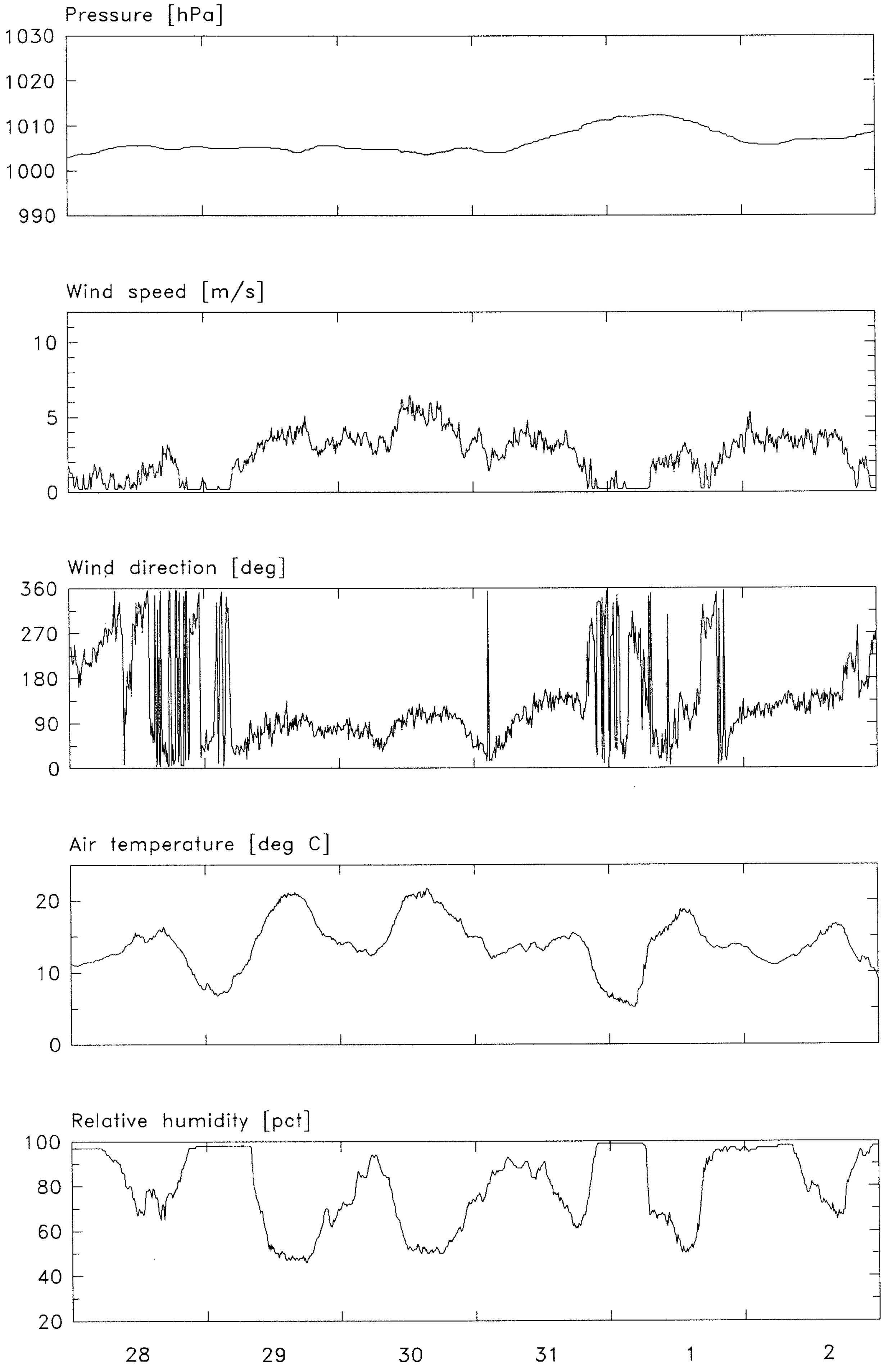


Figure 9. General weather conditions May 22–27, revealed by measurements at the Sjælsmark mast (opposite page) and at the Risø tower (above).


Pressure [hPa]
1030
1020
1010
1000
990
Wind speed [m/s]
10
5
0
Wind direction [deg]
360
270
180
90
0
Air temperature [deg C]
20
10
0
Relative humidity [pct]
100
80
60
40
20
28
29
30
31
1
2

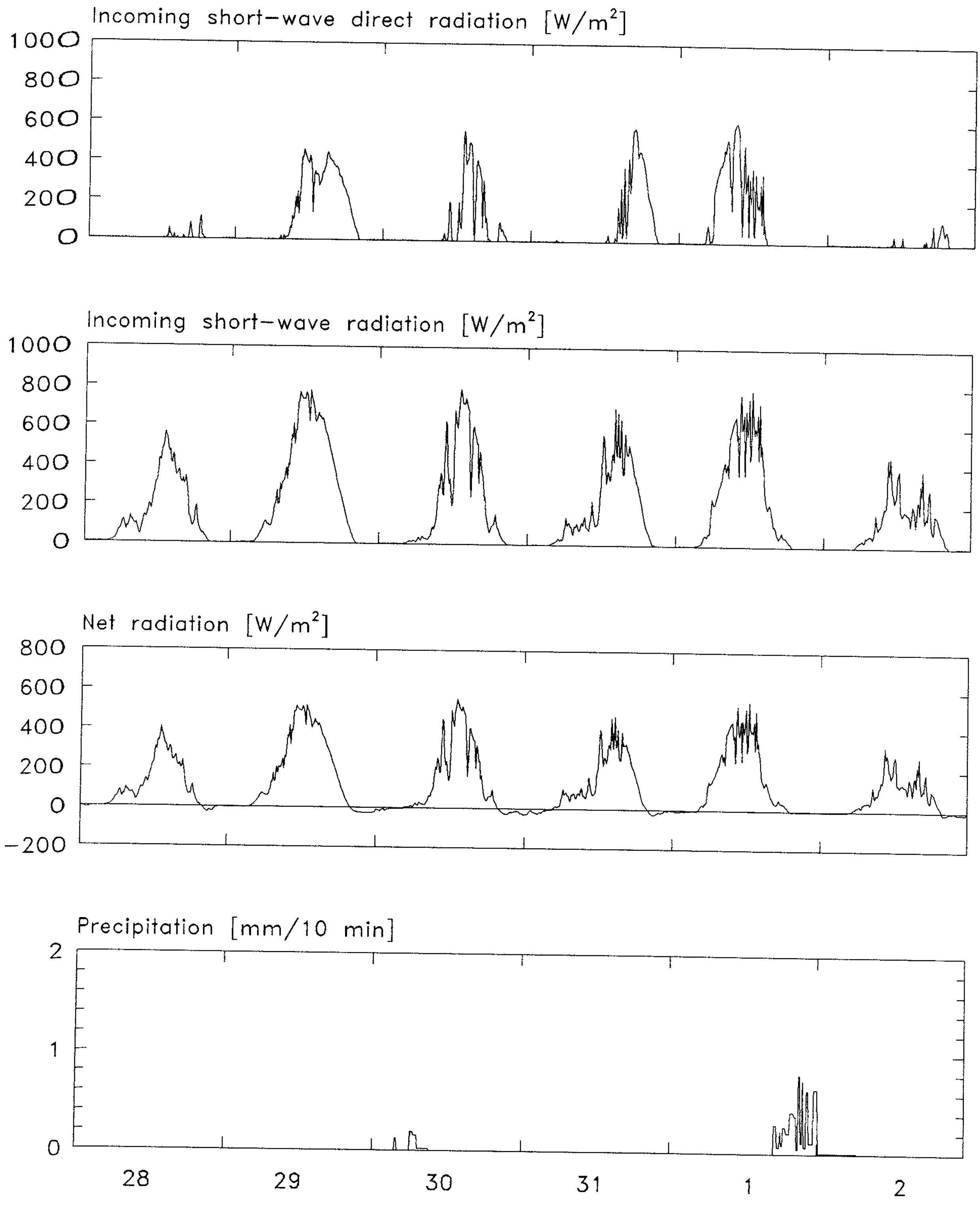
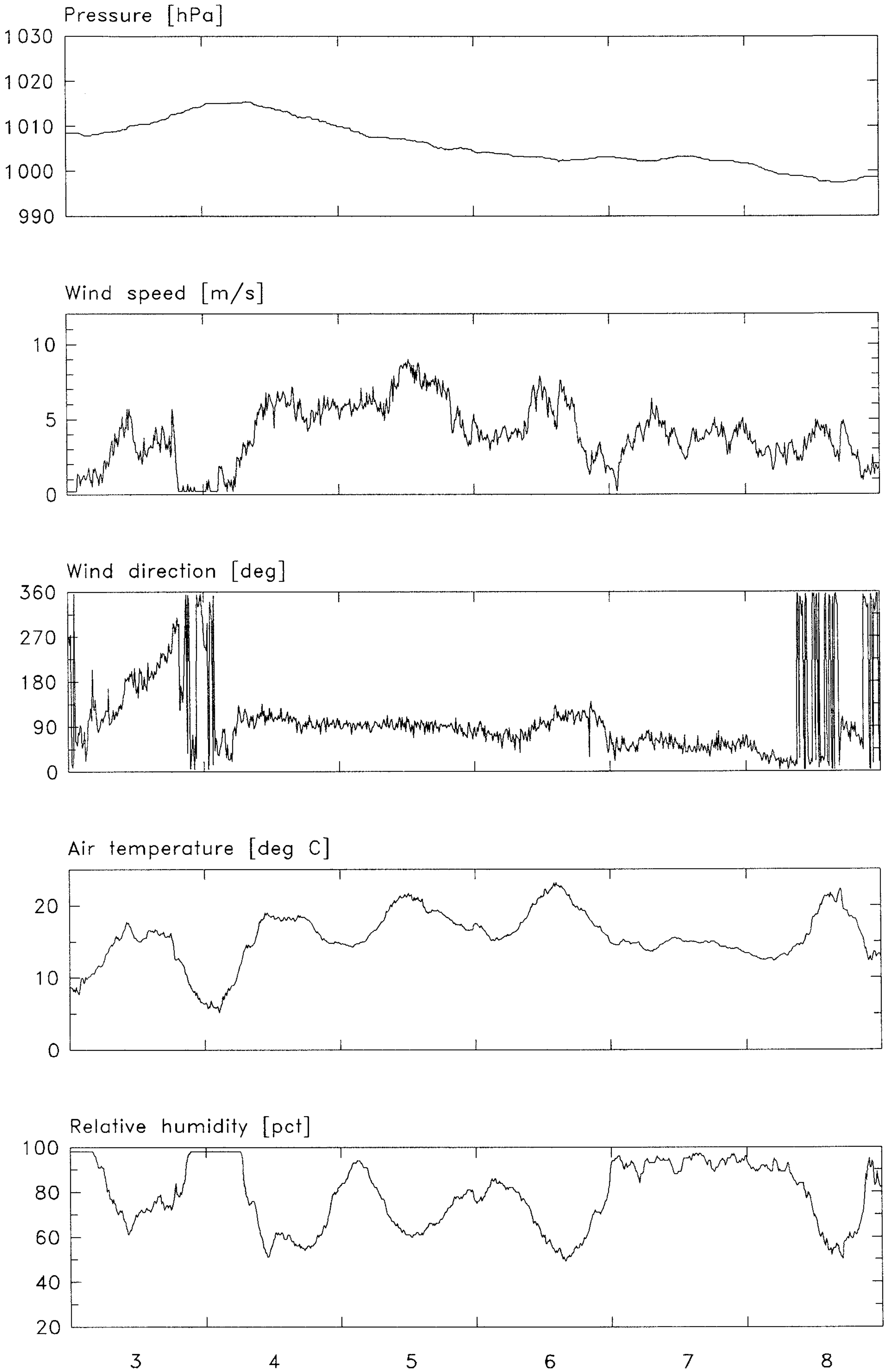


Figure 10. General weather conditions May 28–June 2, revealed by measurements at the Sjælsmark mast (opposite page) and at the Risø tower (above).


Pressure [hPa]
1030
1020
1010
1000
990
Wind speed [m/s]
10
5
0
Wind direction [deg]
360
270
180
90
0
Air temperature [deg C]
20
10
0
Relative humidity [pct]
100
80
60
40
20
3
4
5
6
7
8

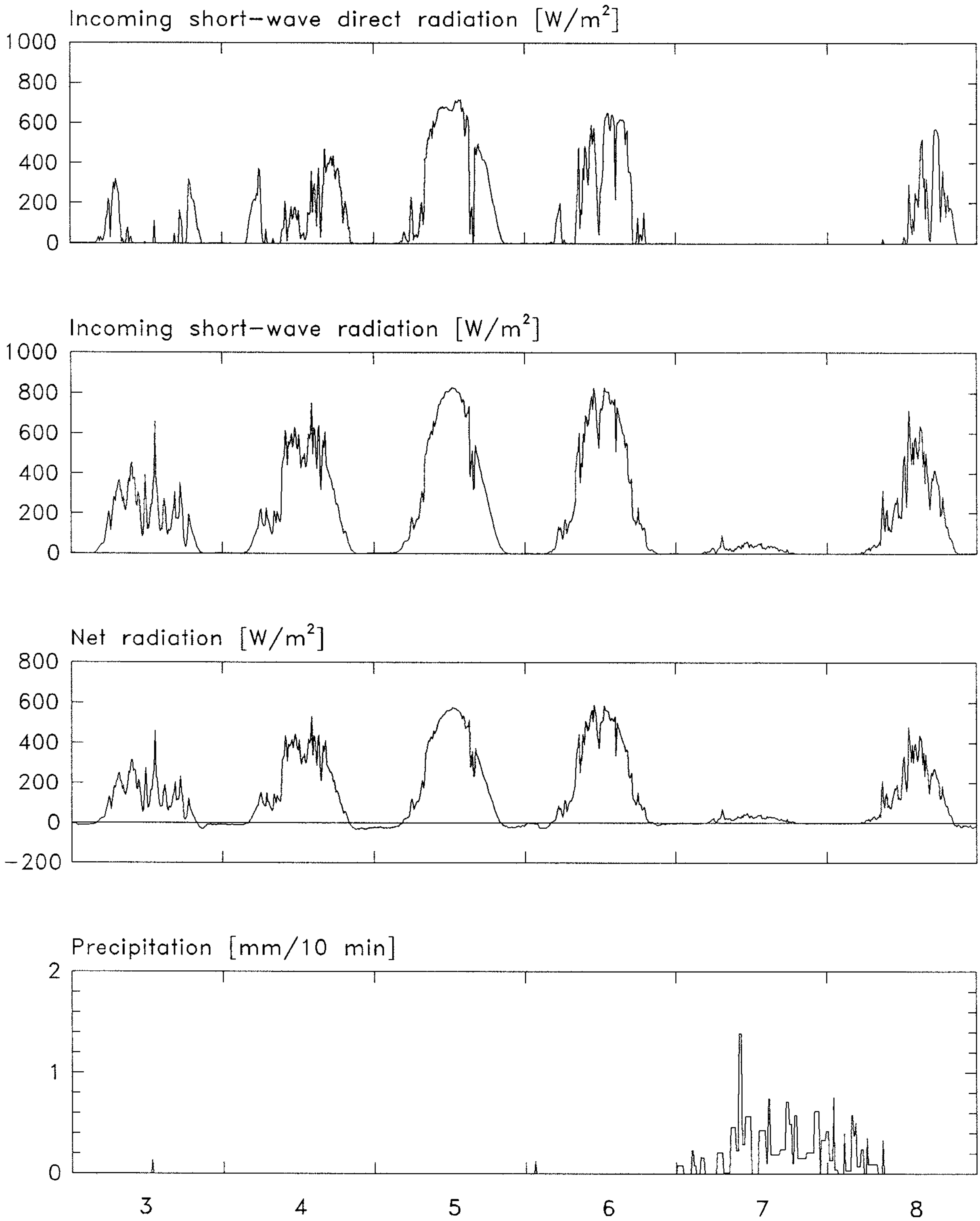
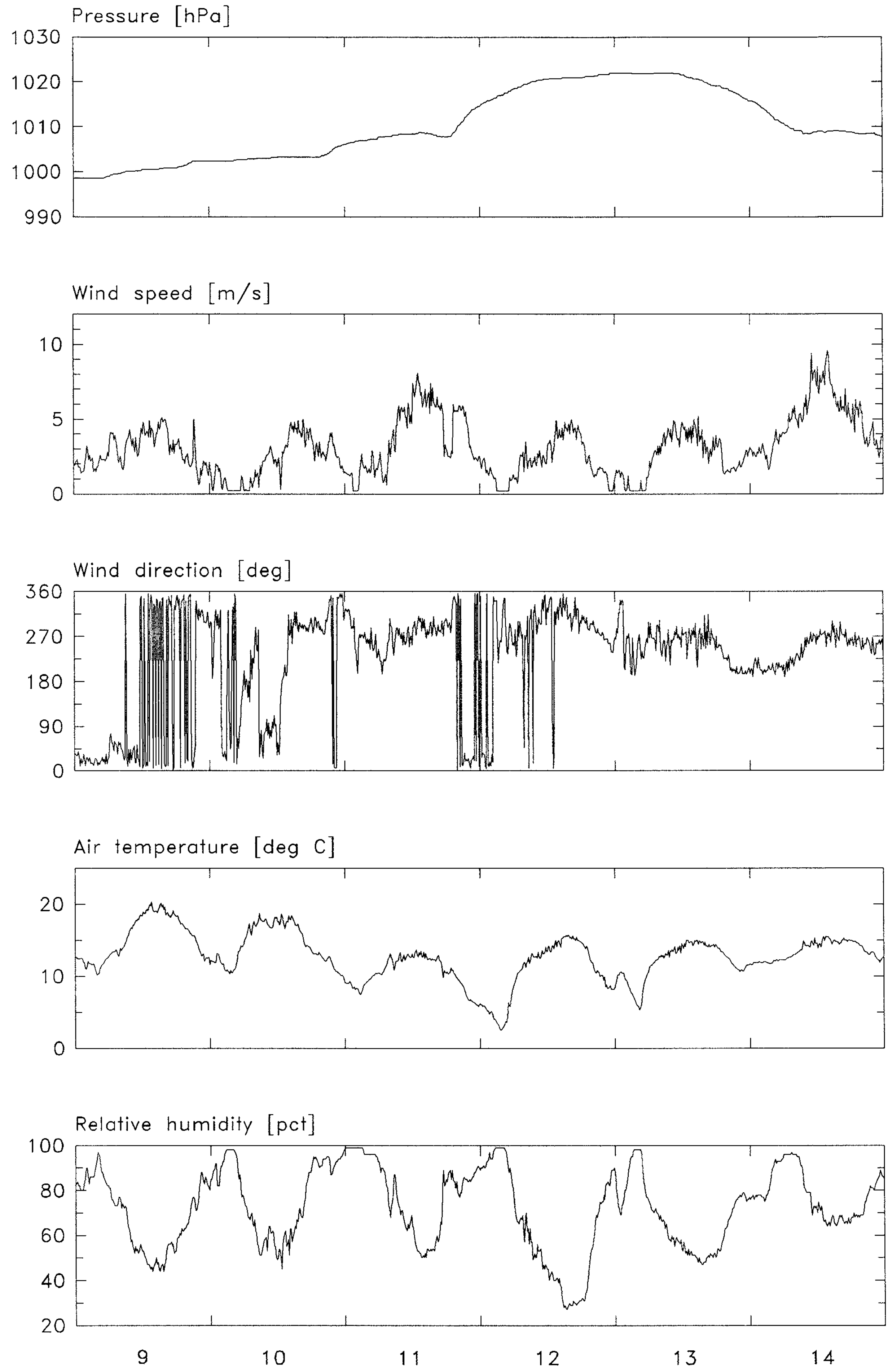


Figure 11. General weather conditions June 3–8, revealed by measurements at the Sjælsmark mast (opposite page) and at the Risø tower (above).


Pressure [hPa]
1030
1020
1010
1000
990
Wind speed [m/s]
10
5
0
Wind direction [deg]
360
270
180
90
0
Air temperature [deg C]
20
10
0
Relative humidity [pct]
100
80
60
40
20
9
10
11
12
13
14

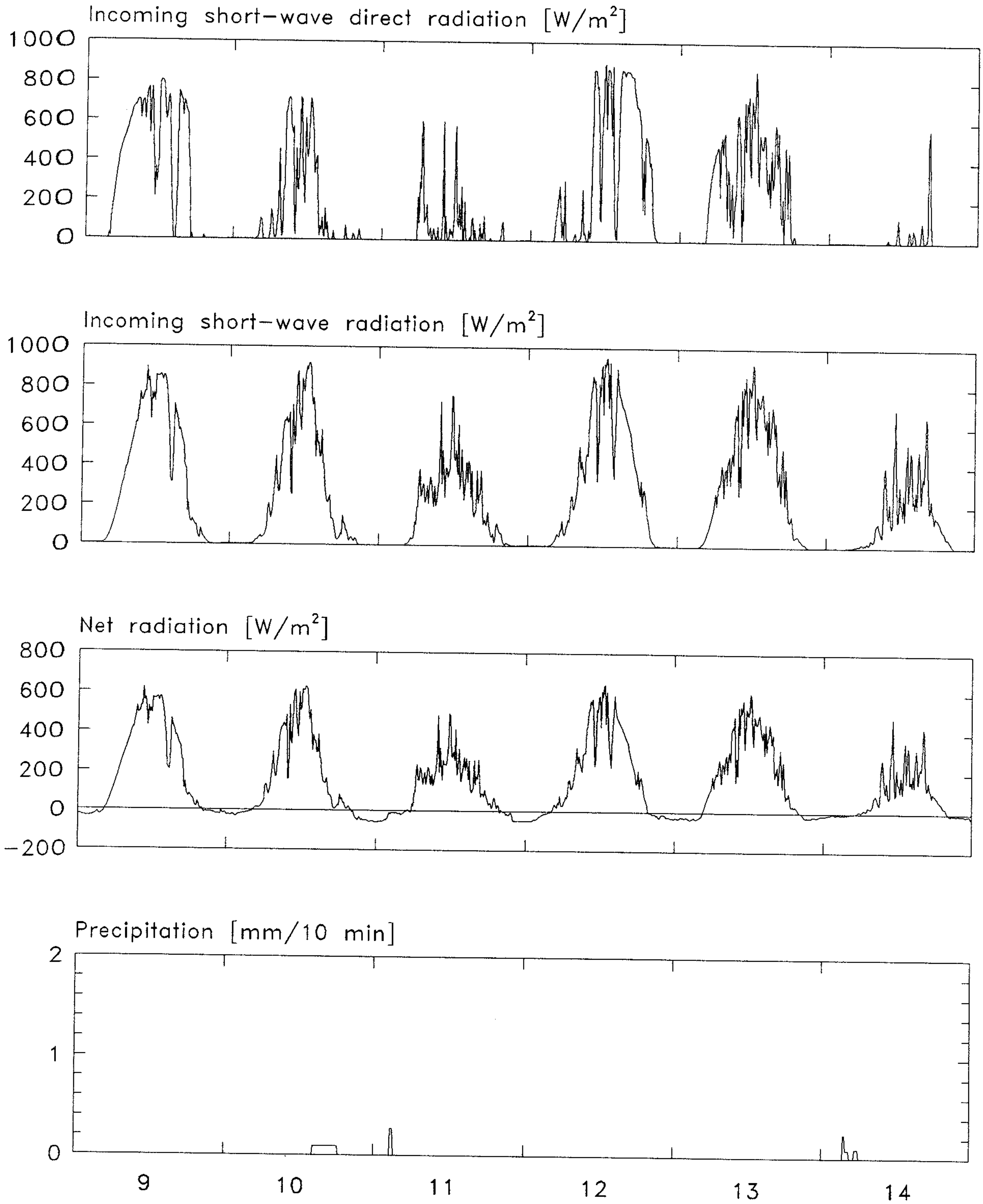


Figure 12. General weather conditions June 9–14, revealed by measurements at the Sjælsmark mast (opposite page) and at the Risø tower (above).

3.2 Sodars

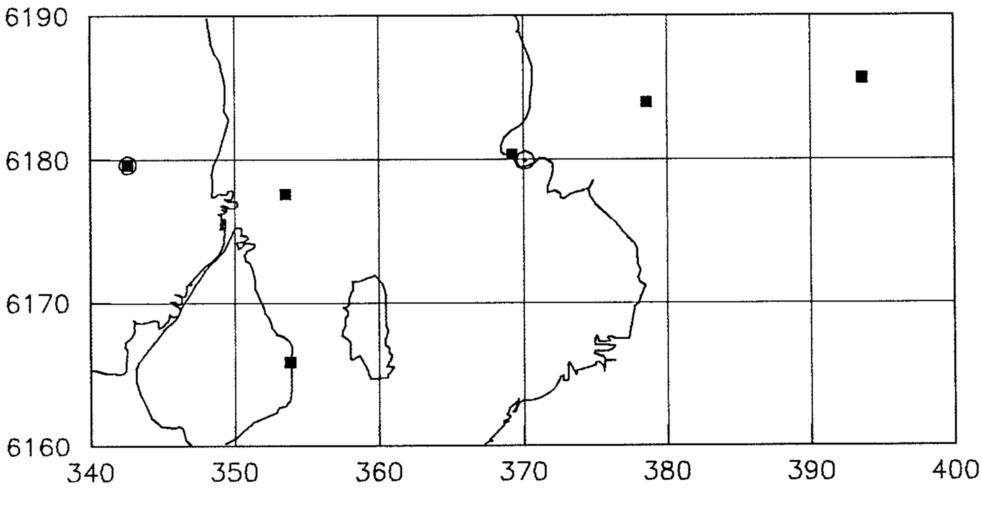
Sodar (SOund Detection And Ranging) systems were employed at six localities:

040	Gladsakse	Smedman and Melas (1986)
041	Middelgrunden	Ericson (1986)
042	Kastrup	Smedman and Melas (1986)
050	Barsebäck	Thaning (1986)
051	Furulund	Salomonsson (1986)
052	Borlunda	Ericson (1986)

The six sodars were tested prior to the experiment, including comparison with wind speed and direction measurements obtained at the 120-m tower at Maglarp (Salomonsson, 1985).

The sodar system employed at Barsebäck during the experiment showed an abnormal low sensitivity and the data quality is uncertain. These measurements are included in the data bank, but are not considered further in this section. The wind speed profiles obtained with the other 5 sodars are illustrated in Figs. 14–18. Each figure shows 1-hour averaged wind speed profiles calculated from the original 10- and 20-min profiles given in the data bank. Notice, that only measurements in the height range 0–500 m a.g.l. are considered. Each profile is 'anchored' at 0 m s^{-1} at ground level (z = 0 m), and consecutive profiles are displaced a fixed amount along the time axis. The length of one day corresponds to 40 m s^{-1}.

Figure 13. Close-up map showing the positions in and around Øresund where sodar systems were employed. The tracer release points are also indicated (⊙).



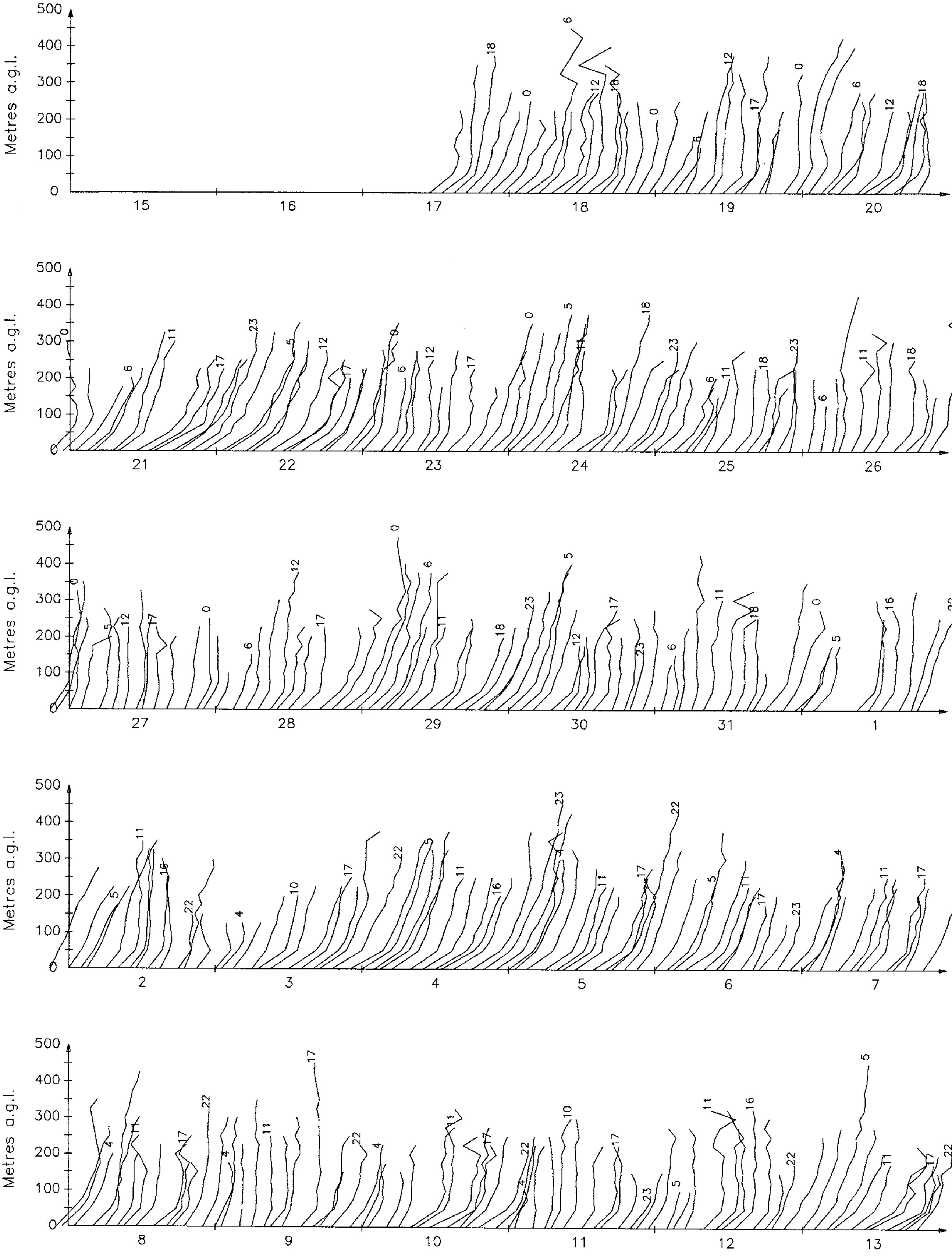


Figure 14. Wind speed profiles at Gladsakse measured with a sodar system. The length of one day corresponds to 40 m s^{-1}.

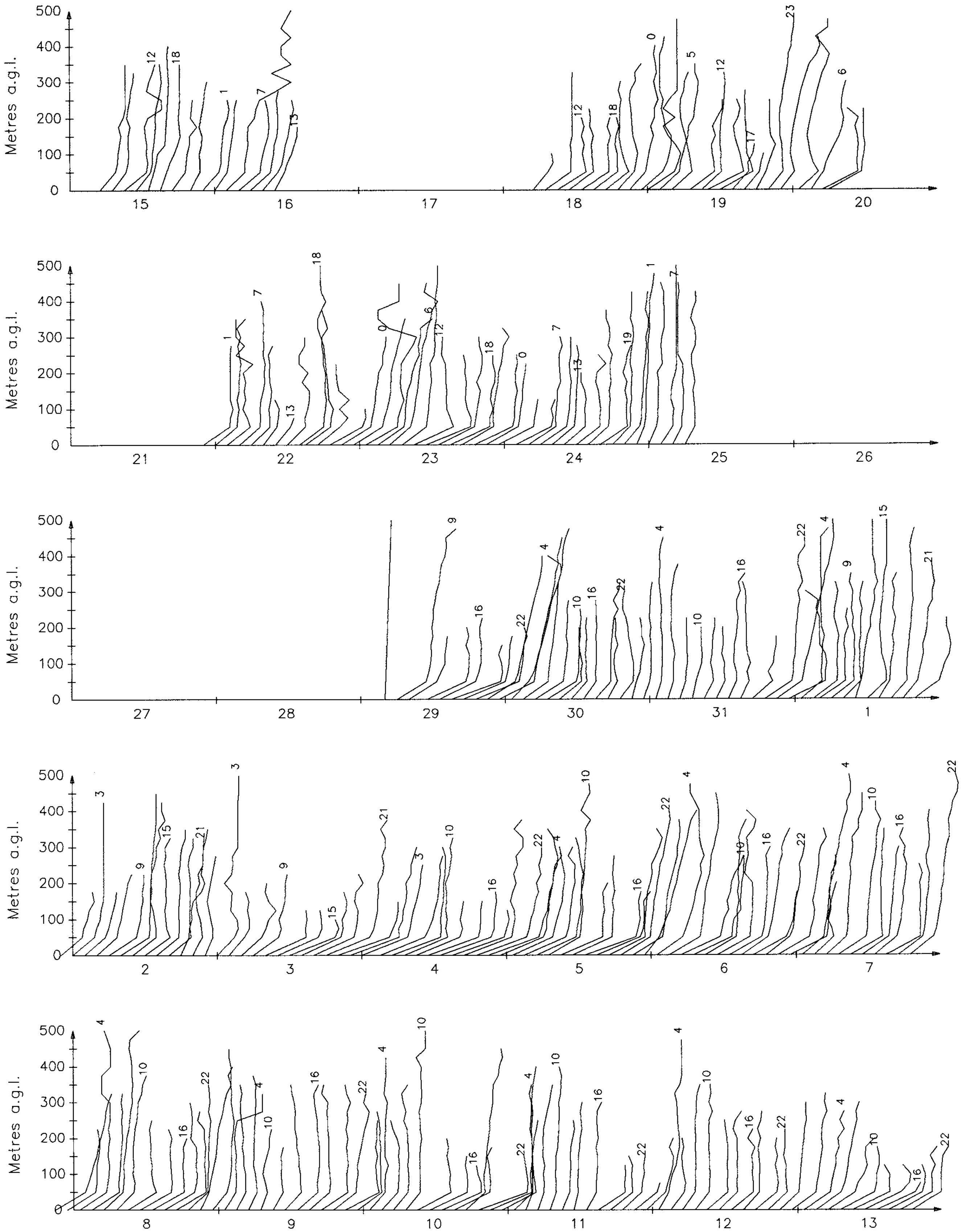


Figure 15. Wind speed profiles at Middelgrunden measured with a sodar system. The length of one day corresponds to 40 m s^{-1}.

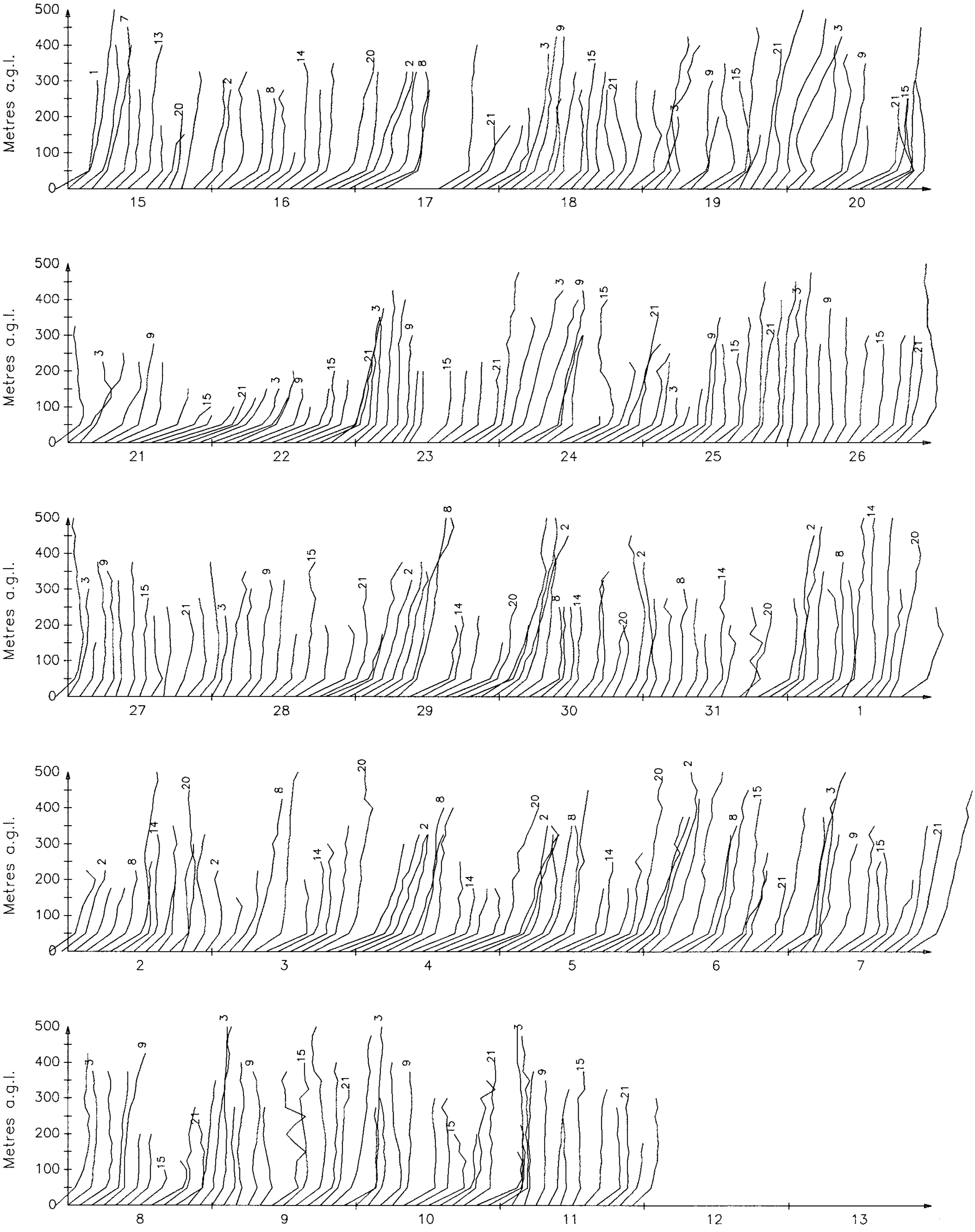


Figure 16. Wind speed profiles at Kastrup measured with a sodar system. The length of one day corresponds to 40 m s^{-1}.

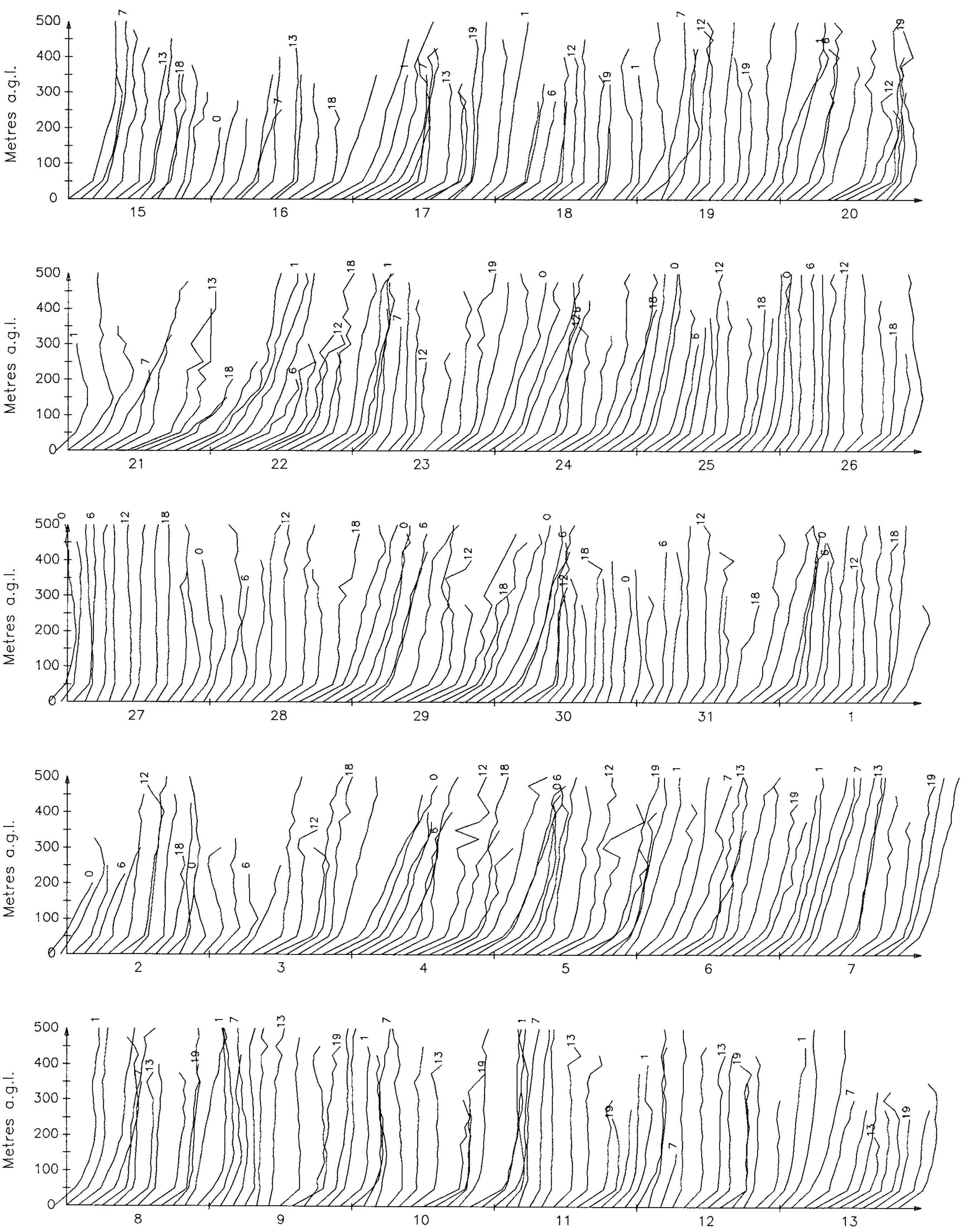


Figure 17. Wind speed profiles at Furulund measured with a sodar system. The length of one day corresponds to 40 m s^{-1}.

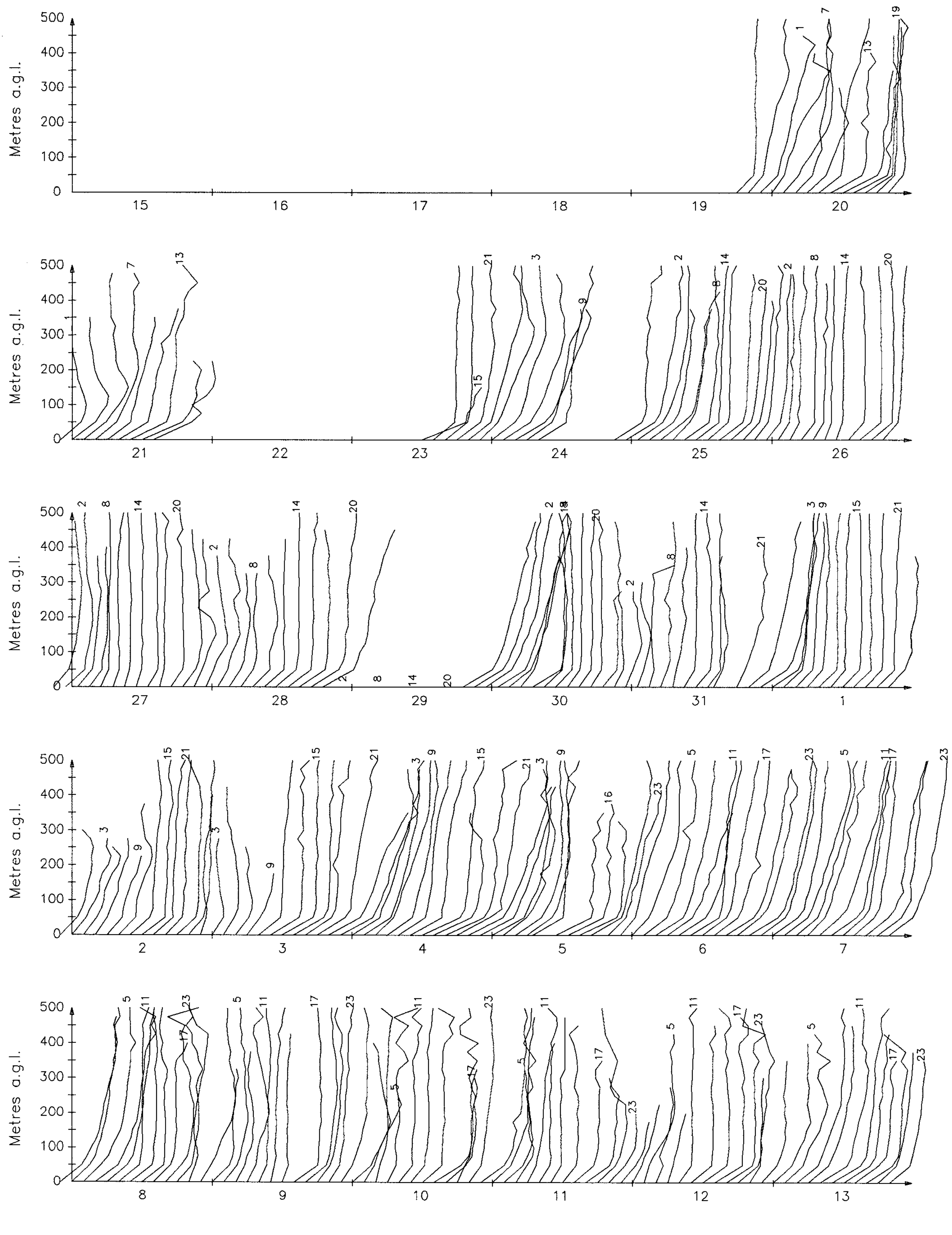


Figure 18. Wind speed profiles at Borlunda measured with a sodar system. The length of one day corresponds to 40 m s^{-1}.

3.3 Radiosondes and balloons

Measurements employing balloons as platforms or 'sensors' were made at several localities:

Radiosondes

061	Jægersborg	Nielsen (1986)
070	Borlunda	Ericson (1986)

Mini-sondes

060	Ballerup	Sivertsen (1986)
062	Øresund	Gryning and Mortensen (1986)
063	Øresund	Ericson (1986)

Tethered balloons (kytoons)

080	Charlottenlund	Tammelin (1986)
091	Barsebäck	Smedman and Melas (1986)

Pilot balloons (pibals)

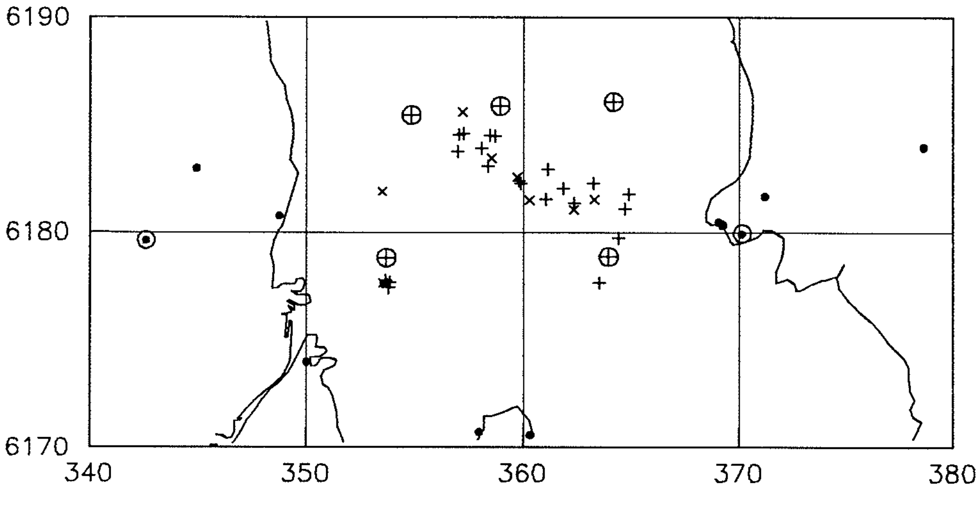
092	Barsebäck	Smedman and Melas (1986)

Tetroon flights

090	Barsebäck	Vogt and Thomas (1986)

Most of these soundings and flights are extensively illustrated in the various technical reports. Therefore, only the structure of the atmospheric boundary layer is illuminated here, by showing the potential temperature profiles at Jægersborg and Borlunda, on either side of the Øresund. The profiles were derived from the soundings and are shown as 'displaced' profiles in Figs. 20 and 21. Notice, that only measurements in the height range 0–2000 m a.s.l. are plotted.

Figure 19. Close-up map showing the positions in Øresund where Risø mini-sondes (+) and SMHI Sprenger sondes (×) were launched. The measuring positions of R/V Aranda are also indicated (⊕) as are the tracer release points (⊙).



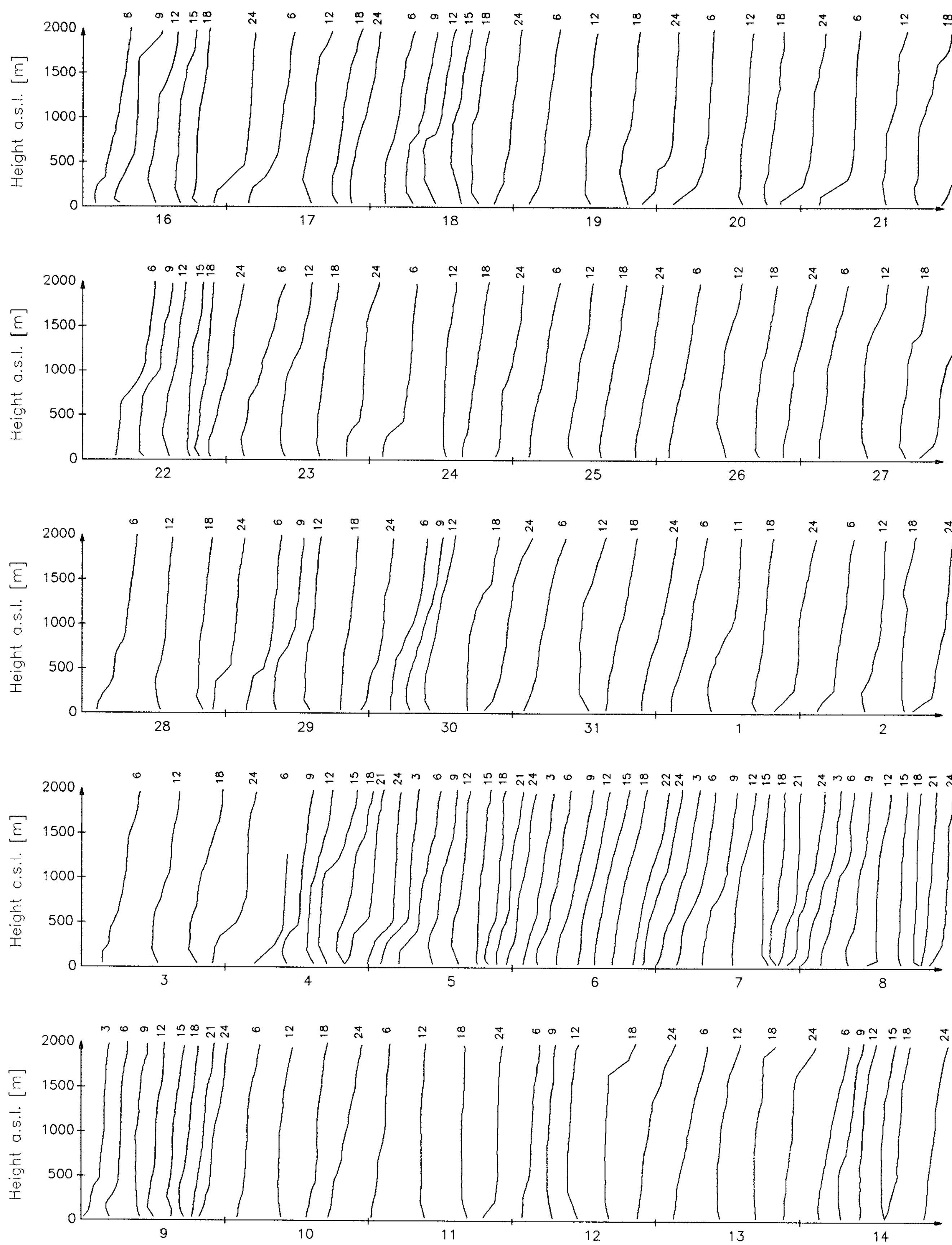


Figure 20. Potential temperature profiles from May 16 to June 14 at Jægersborg, Denmark. The length of one day corresponds to 40 K.

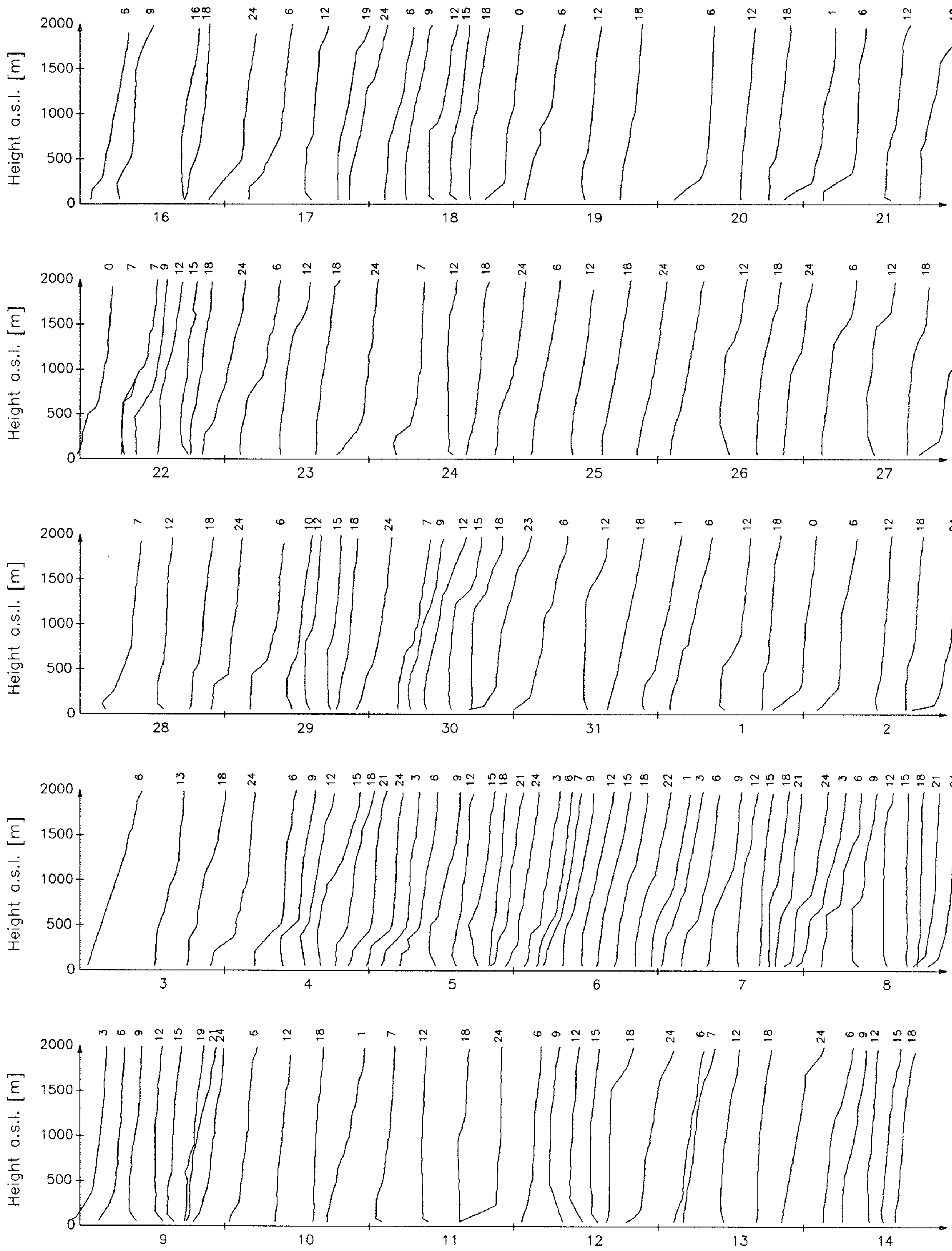


Figure 21. Potential temperature profiles from May 16 to June 14 at Borlunda, Sweden. The length of one day corresponds to 40 K.

3.4 Turbulence

During tracer releases, measurements were carried out of the turbulent wind fluctuations at the height of release (115 m) in the mast at Gladsaxe. Similarly, the turbulent wind, temperature and humidity fluctuations were measured at Barsebäck, the release position in Sweden. The 10-min and 1-hour averaged turbulence statistics derived from these measurements are included in the data bank. Details on the sensors, data acquisition and data reduction are given in the following reports:

100–101	Gladsaxe	Gryning and Mortensen (1986)
110–111	Barsebäck	Smedman and Melas (1986)

3.5 Weather observations

Observations made on a routine basis by airports and the national meteorological institutes of Denmark and Sweden have been included in the data bank. The aviation routine weather reports (METAR) from the airport of Copenhagen (120 Kastrup); synoptic pressure observations at 13 airports in Denmark (121); standard synoptic observations at 20 stations in Sweden (130); and marine meteorological observations at 2 lighthouses in Øresund (148) are examples of the such routine observations. In addition, some ground level observations at Borlunda are also listed here. The level of documentation is generally lower with these types of observations.

120	Kastrup	Gryning and Mortensen (1986)
121	Denmark	no reference available
130	Sweden	Ericson (1986)
148	Øresund	Ericson (1986)
152	Borlunda	Winberg (1986)

3.6 Miscellaneous measurements

During the period May 26 to June 12, 241 temperature profiles up to 10 km a.g.l. were obtained at the Borlunda site (150–151). The profiles were derived from measurements in the zenith direction with the CUT *temperature profiling radiometer (TPR)*. The TPR temperature profiles were measured in between the radiosonde launches, see Section 3.3.

During the tracer experiments on May 29 and June 4, 5 and 12, aircraft measurements were carried out over the experimental area, in particular over the Øresund. The measurements comprised longitudinal turbulence intensity, temperature, dew point temperature and backscattering (149). The aircraft position was originally reported as latitude and longitude, obtained from the VLF/Omega naviagational system. This system is a global navigation system and not really suitable for small scale flights. However, with additional visual ground references and within short time periods, the data can be corrected to yield good positioning results. One such correction procedure is outlined in the data bank.

Finally, some additional measurements from the mast at Charlottenlund are reported here (140).

140	Charlottenlund	Tammelin (1986)
149	Øresund	Sivertsen (1986)
150–151	Borlunda	Winberg (1986)

4 Tracer measurements

Nine tracer experiments were performed on 9 different days during the Øresund Experiment. In each experiment the tracer was released close to the upwind coastline and sampled in the Øresund, at the downwind coastline and further inland. The experiments comprised time-averaged tracer concentration measurements from a fixed set-up of sampling units and instantaneous tracer measurements from a van, an aircraft and a boat. Figure 22 provides an overview of these 9 experiments and Fig. 3 shows how these data are organized in the data bank.

Date	Release	Arc 1	Arc 2	Arc 3	Arc 4	Van	Plane	Boat
16	BB	APL	SCK	—	—	SCK	—	—
18	GL	APL	APL	—	—	—	—	—
22	BB	APL	SCK	APL	—	SCK	—	—
29	BB	APL/SCK	APL/SCK	—	—	SCK	—	—
30	BB	SCK	—	—	—	—	—	—
4	BB	APL	SCK	APL	NILU	SCK	NILU	—
5	BB	APL	APL	SCK	NILU	SCK	NILU	NILU
12	GL	APL	SCK/APL	—	—	SCK	NILU	—
14	GL	APL	SCK	APL	—	—	—	—

Figure 22. Overview of all tracer concentration measurements performed during the Øresund Experiment. BB means release at Barsebäck in Sweden, GL at Gladsaxe in Denmark. The acronyms refer to the three data-collecting institutions, see Section 1.

The release of the tracer SF_6 (sulphur-hexafluoride) was performed as a non-buoyant release from a meteorological tower in either Denmark (Gladsaxe) or Sweden (Barsebäck):

Release position	Easting [m]	Northing [m]	Elevation [m] a.s.l.	Release height [m] a.g.l.
Gladsaxe	342580	6179610	45	115
Barsebäck	370130	6179910	5	95

4.1 Time-averaged

The time-averaged tracer measurements are described and illustrated in detail by Lyck and Olesen (1986), Sivertsen (1986), and Vanderborght (1986). In each experiment the tracer was sampled by a number of stationary automatic sampling units. The sampling units were set up in one or more arcs; the first arc was located close to the coastline and the following arcs farther inland. Figure 23 summarizes these experiments and an example of a sampling unit set-up is given in Fig. 25.

The time-averaged tracer measurements are illustrated in Figs. 25–42; each opening corresponding to the experiment on one particular day. The left-hand page of each opening shows the sampling unit set-up and release point on a map of the experimental area. The right-hand pages show the tracer distributions measured along the arcs – in this case 1-hour averaged tracer concentrations versus cross-wind distance. For this purpose the processed 1-hour-averaged tracer concentrations calculated by Lyck and Olesen (1986) were used. These data are also included in the data bank as file 201 (Fig. 3). Data from all three institutions – APL, NILU and SCK – were merged and subjected to the following procedure (Lyck and Olesen, 1986):

Date 1984 MODA	Release position	Release start CET	Sampling from CET	Sampling to CET	Number of arcs	Number of sampling positions
0516	Barsebäck	09:30	13:30	14:30	2	44 + 10
0518	Gladsaxe	08:30	12:20	13:20	2	22 + 22
0522	Barsebäck	09:00	11:00	12:00	3	15 + 10 + 16
0529	Barsebäck	08:00	11:00	12:00	2	22 + 22
0530	Barsebäck	08:00	11:00	12:00	1	10
0604	Barsebäck	08:30	11:00	12:00	4	12 + 10 + 11 + 10
0605	Barsebäck	08:00	11:00	12:00	4	13 + 14 + 11 + 24
0612	Gladsaxe	08:30	12:00	13:00	2	30 + 16
0614	Gladsaxe	10:15	13:00	14:00	3	22 + 10 + 21

Figure 23. Summary of time-averaged tracer measurements. Individual sampling times can deviate from the times listed below.

- Hourly tracer concentration averages – less background and including some interpolated values – were determined.
- A basic projection point for each tracer sampling arc were found.
- Each tracer sampling point has been projected on a cross-wind line through the basic projection point.
- Tracer distribution parameters have been determined on basis of the above mentioned calculations. These include the standard deviation of the tracer concentration profile, σ_y, and the crosswind-integrated tracer concentration, CONCCWI.

The tracer distribution characteristics thus obtained are summarized in Fig. 24. Notice, that the table also includes results of the measurements performed by SCK (Vanderborght, 1986) and NILU (Sivertsen, 1986) – as calculated by APL (Lyck and Olesen, 1986).

4.2 Instantaneous

During the tracer experiments on May 29 and June 4, 5 and 12, air samples were taken from the NILU aircraft along several traverses over the experimental area. Furthermore, on June 5, a cross-wind SF_6 profile over the Øresund was obtained from a boat.

Mobile SF_6 concentration measurements were conducted by SCK from a van. The purpose of these measurements was twofold: first, to determine the position of the tracer plume before the time-averaged sampling was started, in order to obtain the best coverage with the stationary sampling units; secondly, to measure the variation in time of SF_6-concentration at a fixed point in the plume during the 1-hour sampling.

The instantaneous tracer measurements are reported in:

210	Van	Vanderborght (1986)
211	Aircraft	Sivertsen (1986)
212	Boat	Sivertsen (1986)

Vanderborght (1986) also contains a detailed logbook of the tracer experiments.

Date 1984 MODA	Release position	Background [$10^{-9}gm^{-3}$]	Arc #	Distance to arc [km]	σ_y [m]	CONCCWI [$10^{-6}gm^{-2}$]	Note
0516	Barsebäck	7.8	1	36.3	(2039)	(4445)	1
			2	38.4	—	—	2
0518	Gladsaxe	11.1	1	31.7	(2121)	552	3
			2	33.5	(2037)	879	3
0522	Barsebäck	9.8	1	22.2	985	947	–
			2	22.6	(944)	(881)	4
			3	25.3	1145	978	–
0529	Barsebäck	9.4	1	22.0	1215	498	–
			2	25.5	1449	479	–
0530	Barsebäck	11.0	1	—	—	—	5
			2	32.8	(1585)	(122)	6
			3	—	—	—	5
0604	Barsebäck	9.1	1	22.0	922	445	–
			2	23.6	(716)	(596)	7
			3	25.3	1110	534	–
			4	30.0	(687)	(440)	8
0605	Barsebäck	9.1	1	22.0	619	1632	–
			2	25.3	983	1817	–
			3	27.2	(972)	(2316)	9
			4	30.0	(950)	(1636)	10
0612	Gladsaxe	8.4	1	29.1	(1771)	(81)	11
			2	34.8	(2367)	(346)	11
0614	Gladsaxe	7.9	1	34.6	3275	700	–
			2	36.1	(1406)	(234)	12
			3	42.0	3293	631	–

1. A northern part of the tracer plume is not covered by the sampling unit set-up. Small patches of the tracer plume south of position (345900, 6197810) are not included in the σ_y calculation.
2. A northern and a minor southern part of the tracer plume are not covered by the sampling unit set-up. Sampling start-times varied from 13:22 to 13:41 (sampling start-time for arc 1 is 13:30).
3. Before the tracer plume reached the coast it split up into a main northern and minor southern part. The integrated concentration of the southern part is only a few percent of the total. The calculated σ_y's are for the main plume only, and may therefore not be descriptive for the spread of the plume.
4. Major parts of the tracer plume, to the north and south, are not covered by the sampling unit set-up.
5. The sampling unit set-up along the coast from (347900, 6178500) to (348140, 6189930) and inland from (345290, 6177040) to (343600, 6193650) was outside the tracer plume.
6. A northern part of the plume is not covered by the sampling unit set-up.
7. The northern edge of the plume is not covered by the sampling unit set-up.
8. The averaging time is only half an hour, from 12:45 to 13:15. During this period a northern part of the plume is not covered by the set-up. (in arc 1, 2 and 3 sampling takes place from 12:00 to 13:00).
9. The northern edge of the tracer plume is not covered by the set-up.
10. A northern part of the tracer plume is not covered by the set-up. Small patches of the tracer plume south of (337900, 6172550) have been omitted in the σ_y calculation.
11. The tracer plume disappears from the sampling area during sampling. Measured tracer concentrations above background values are from the first $\frac{1}{2}$ to $\frac{3}{4}$ of the sampling time. The APL sampling unit set-up (arc 2), on both sides of the SCK/CEN set-up, completes the coverage of the plume. APL sampling from 12:00 to 13:00, SCK sampling from 11:45 to 12:55.
12. Most of the northern part of the tracer plume is not covered by the sampling unit set-up.

- Implies that the tracer-concentration measurements constitute a well-defined complete crosswind distribution.

Figure 24. Characteristics of the 1-hour averaged tracer concentration distributions (Lyck and Olesen, 1986). The measuring arcs are numbered from the coast and inland. Numbers in brackets must be interpreted with care – please consult the notes following the table. Further explanation in text.

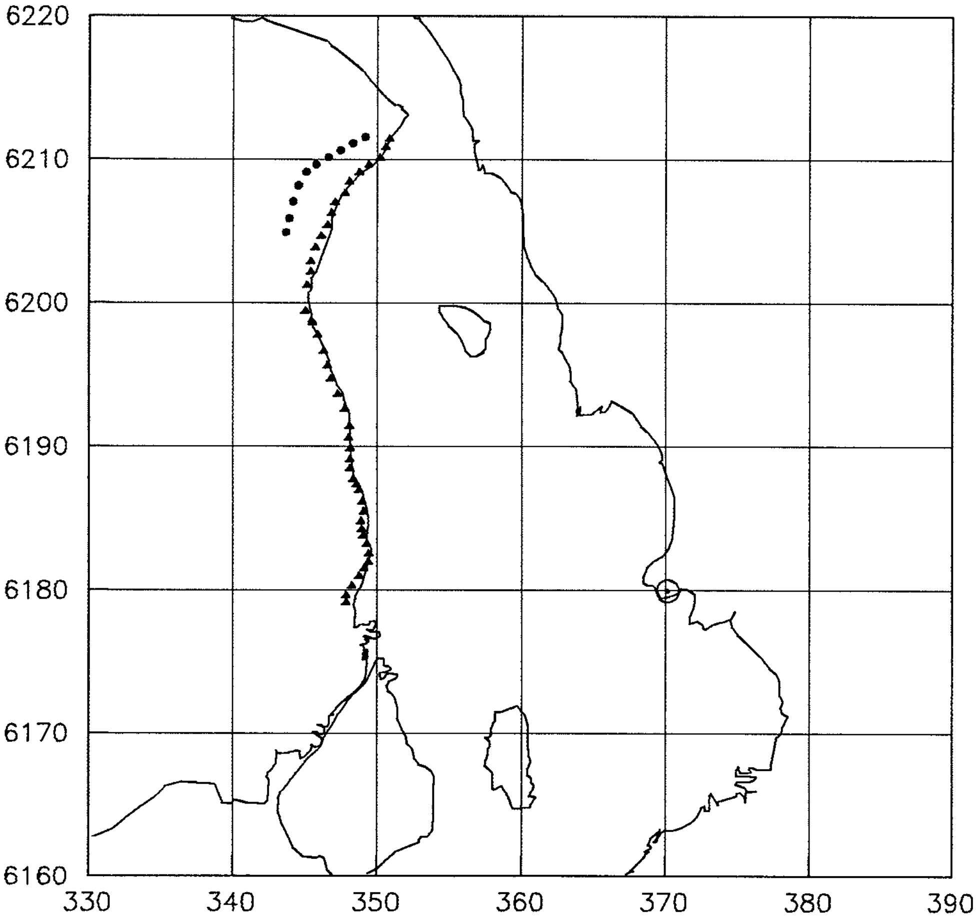


Figure 25. Tracer experiment on May 16. The sampling sites of APL (△), SCK (•) and NILU (■) are indicated (Figure 22). The tracer release point is also indicated (⊙).

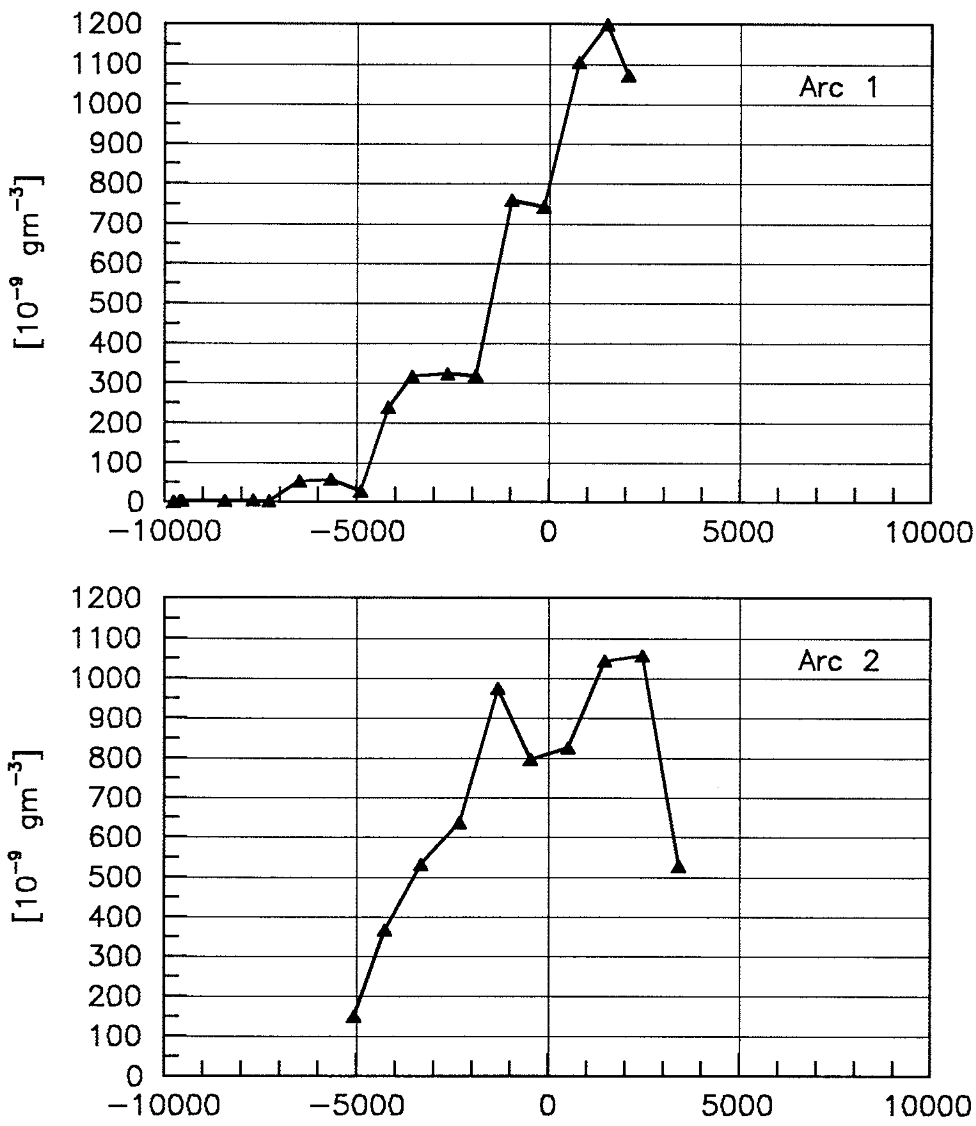


Figure 26. Tracer concentrations (nano-grammes of SF_6 per cubic-metre) averaged over one hour versus cross-wind distance – on May 16.

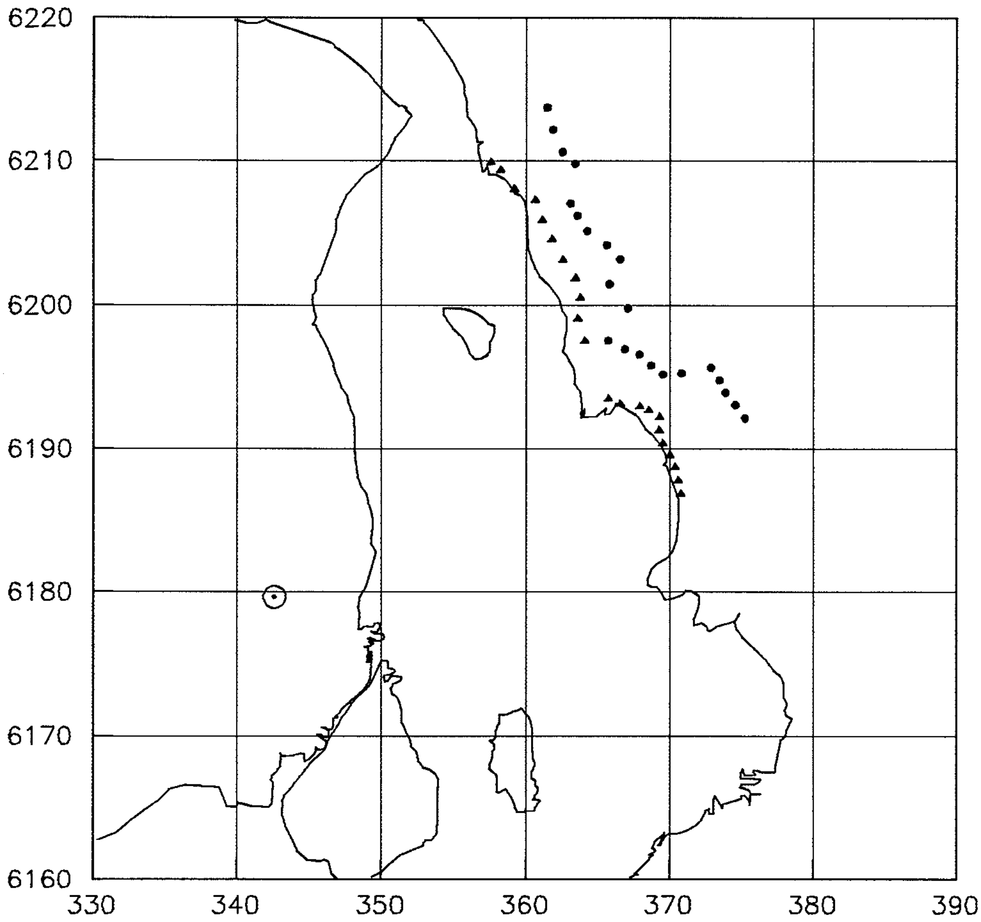


Figure 27. Tracer experiment on May 18. The sampling sites of APL (△), SCK (•) and NILU (■) are indicated (Figure 22). The tracer release point is also indicated (⊙).

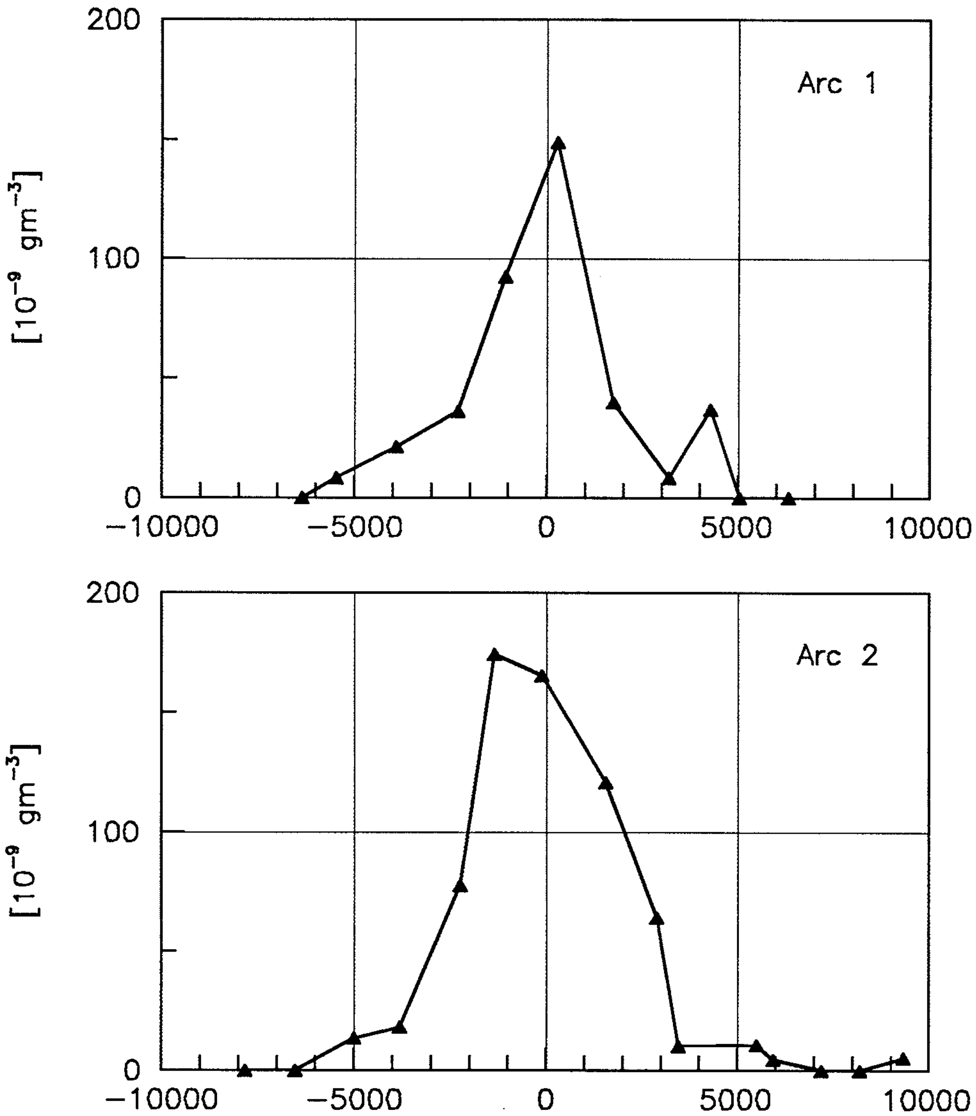


Figure 28. Tracer concentrations (nano-grammes of SF_6 per cubic-metre) averaged over one hour versus cross-wind distance – on May 18.

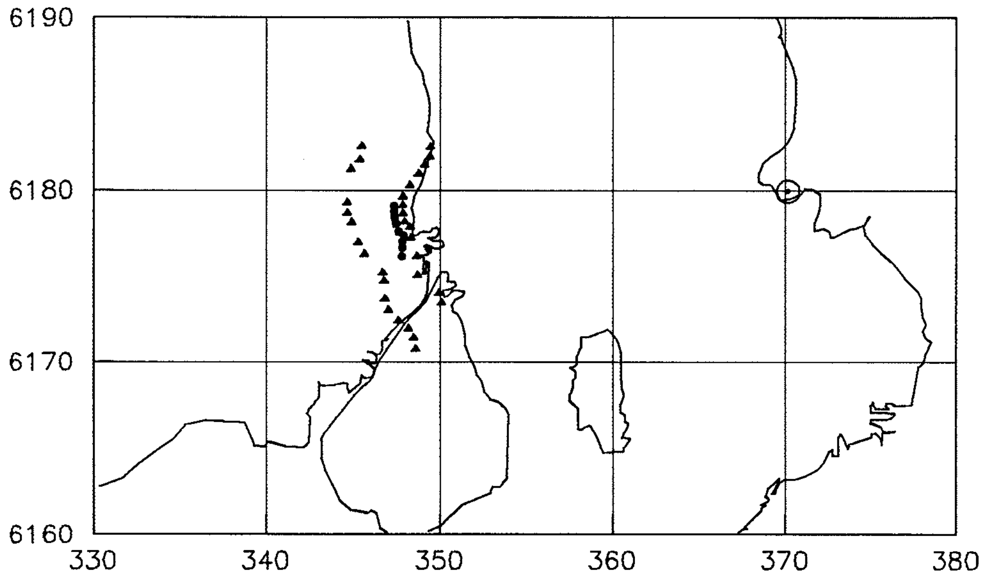


Figure 29. Tracer experiment on May 22. The sampling sites of APL (△), SCK (•) and NILU (▪) are indicated (Figure 22). The tracer release point is also indicated (⊙).

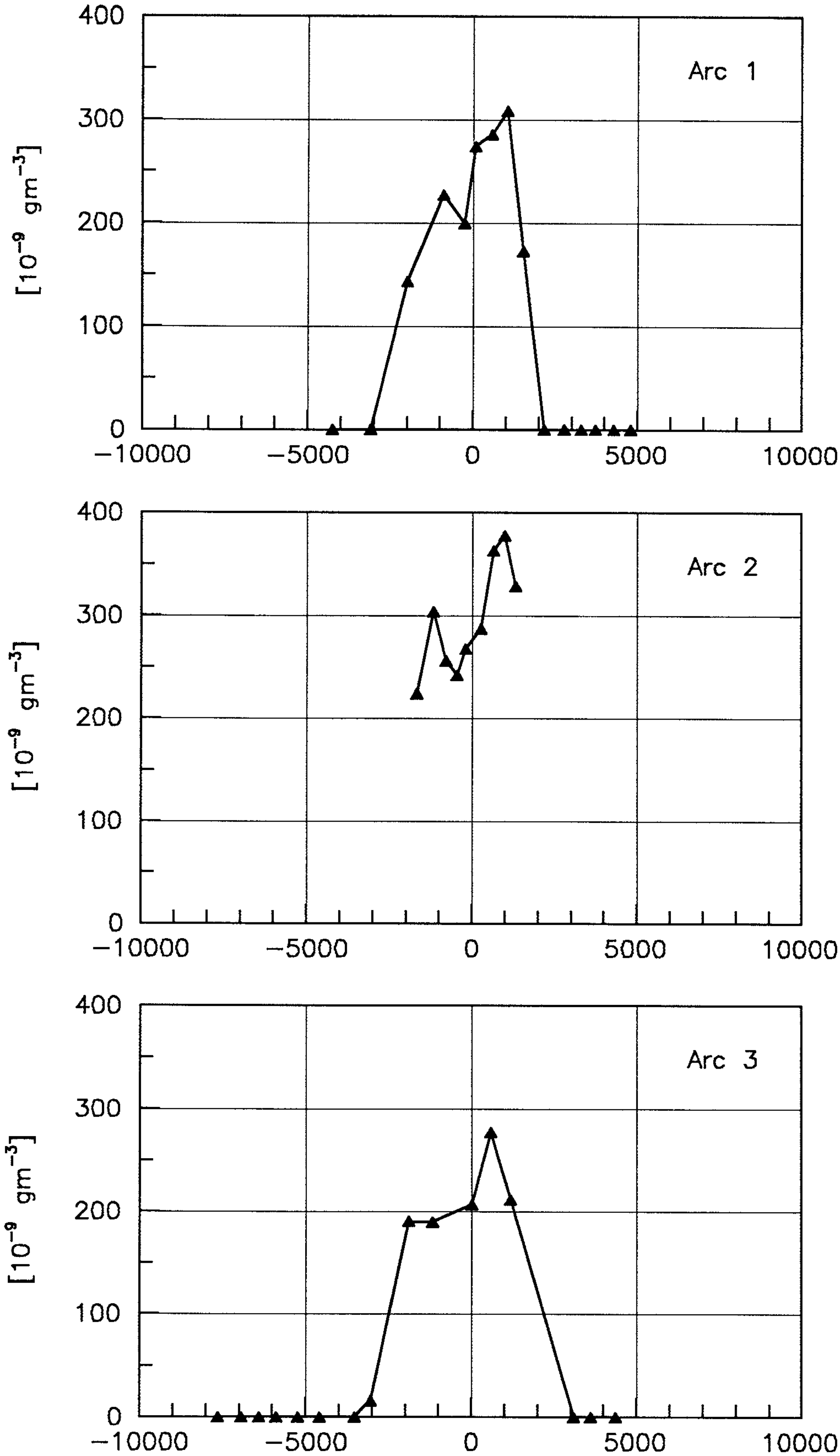


Figure 30. Tracer concentrations (nano-grammes of SF_6 per cubic-metre) averaged over one hour versus cross-wind distance – on May 22.

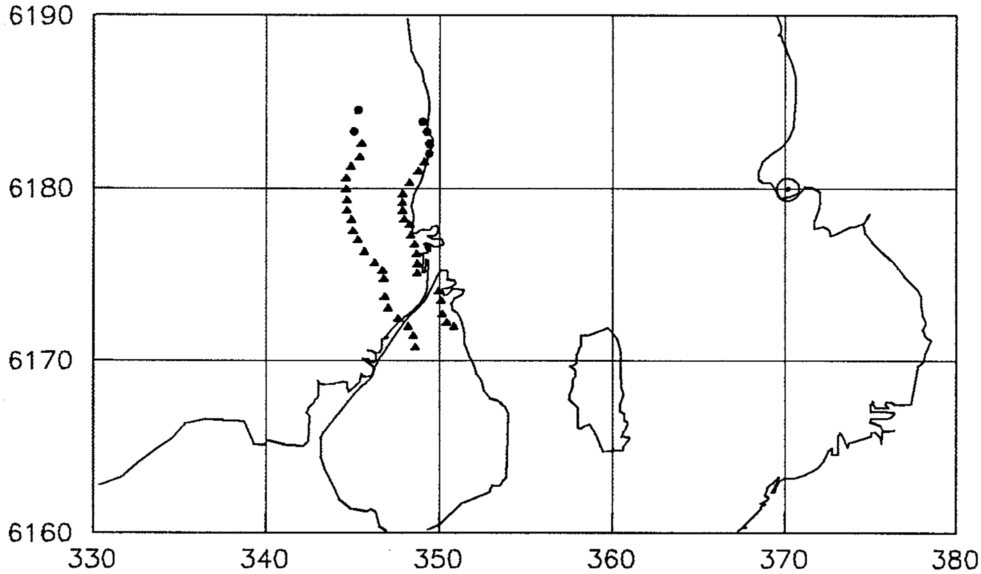


Figure 31. Tracer experiment on May 29. The sampling sites of APL (△), SCK (•) and NILU (■) are indicated (Figure 22). The tracer release point is also indicated (⊙).

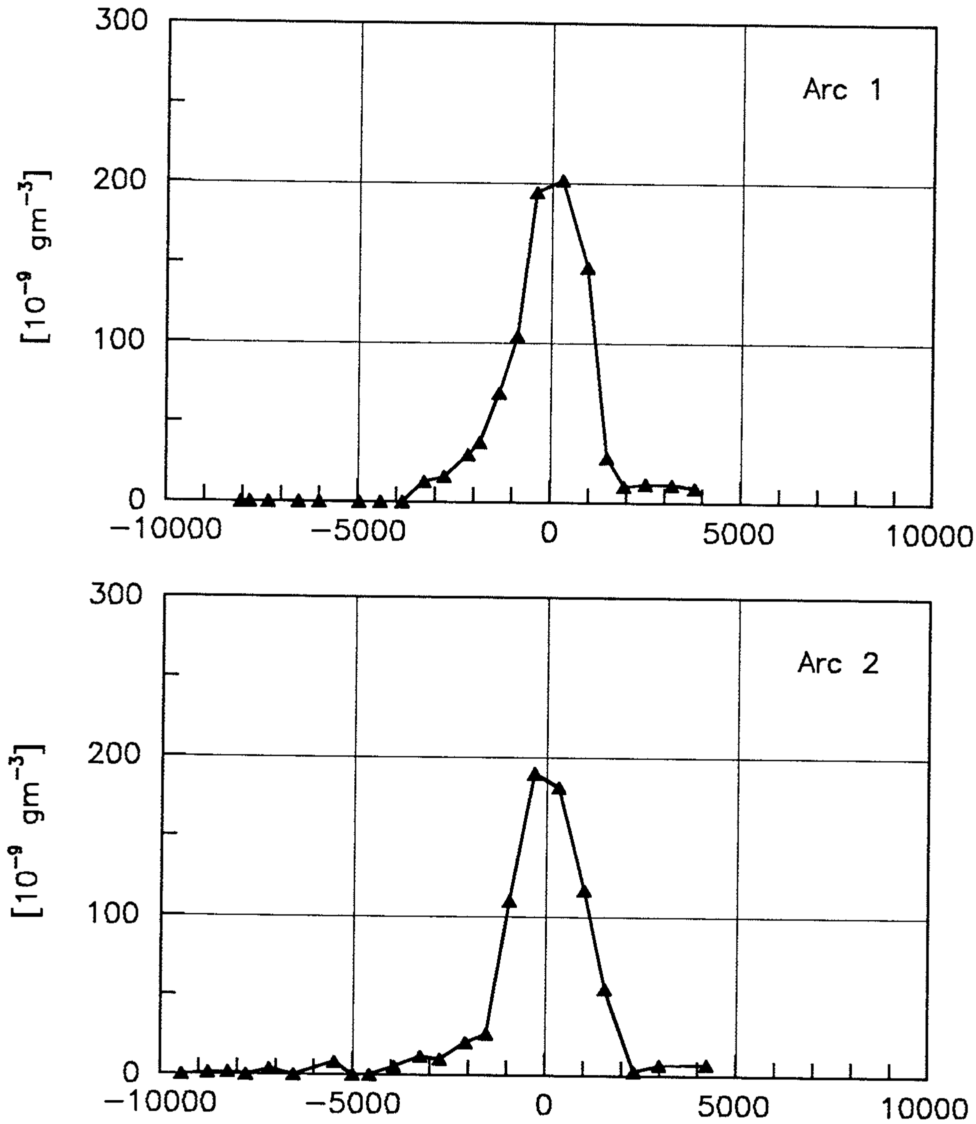


Figure 32. Tracer concentrations (nano-grammes of SF_6 per cubic-metre) averaged over one hour versus cross-wind distance – on May 29.

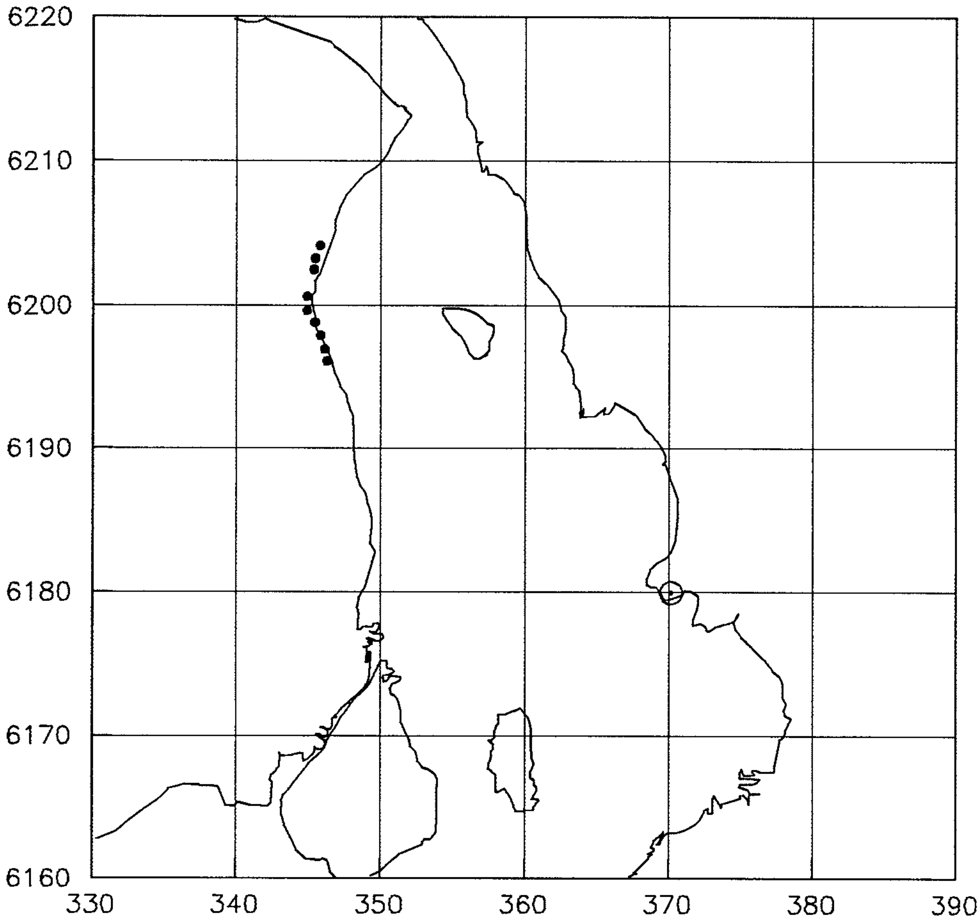


Figure 33. Tracer experiment on May 30. The sampling sites of APL (△), SCK (•) and NILU (▪) are indicated (Figure 22). The tracer release point is also indicated (⊙).

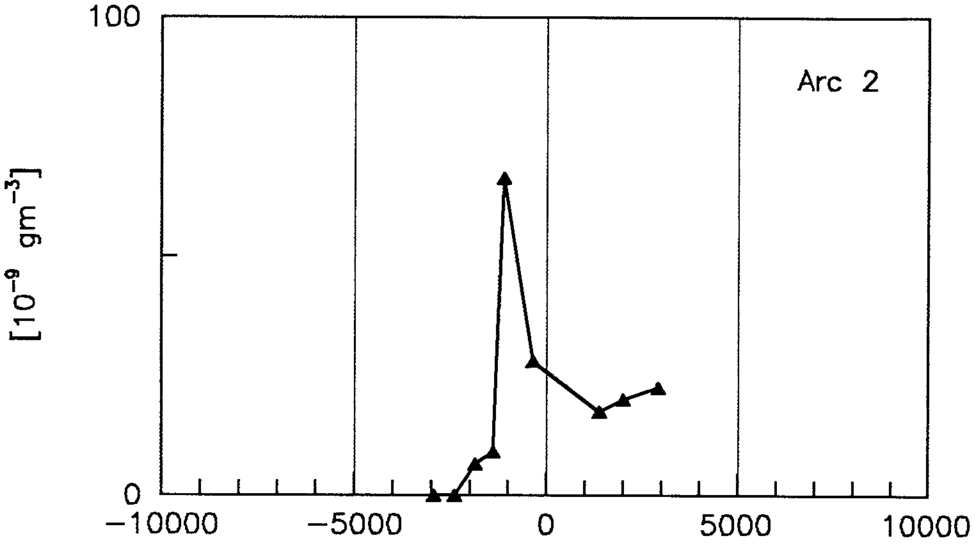


Figure 34. Tracer concentrations (nano-grammes of SF_6 per cubic-metre) averaged over one hour versus cross-wind distance – on May 30.

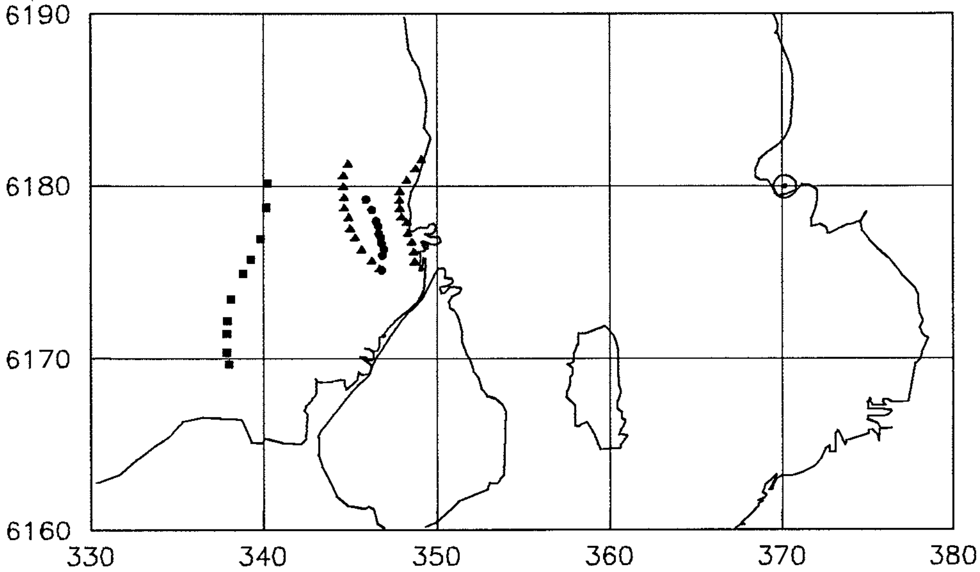
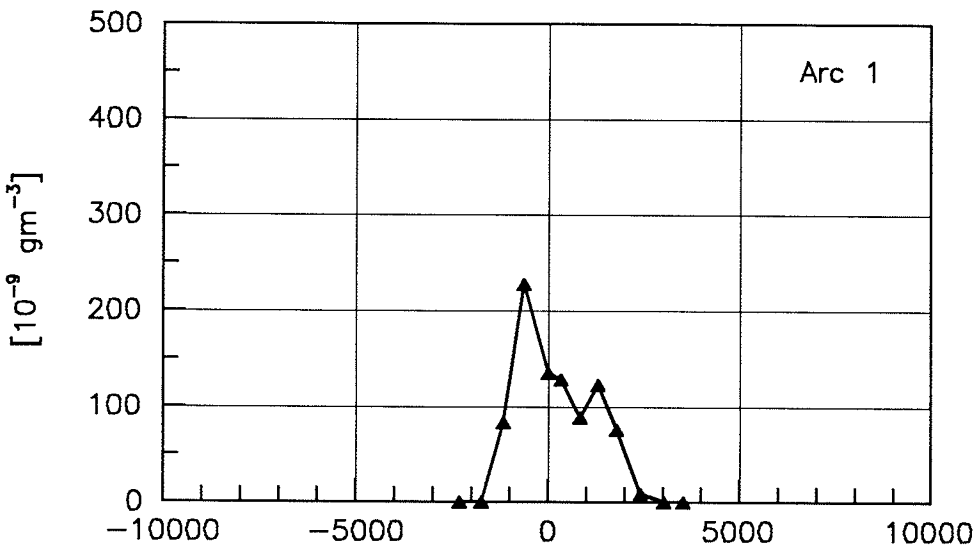
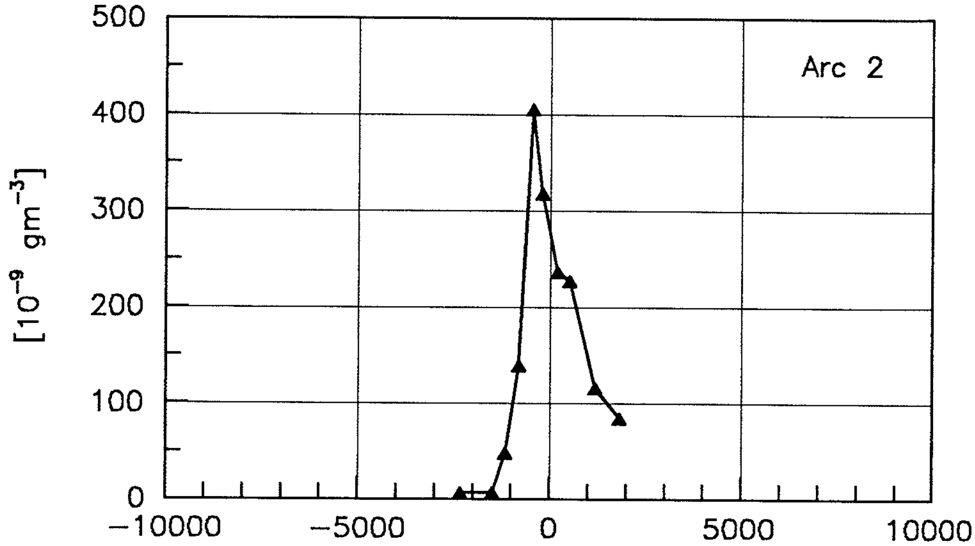
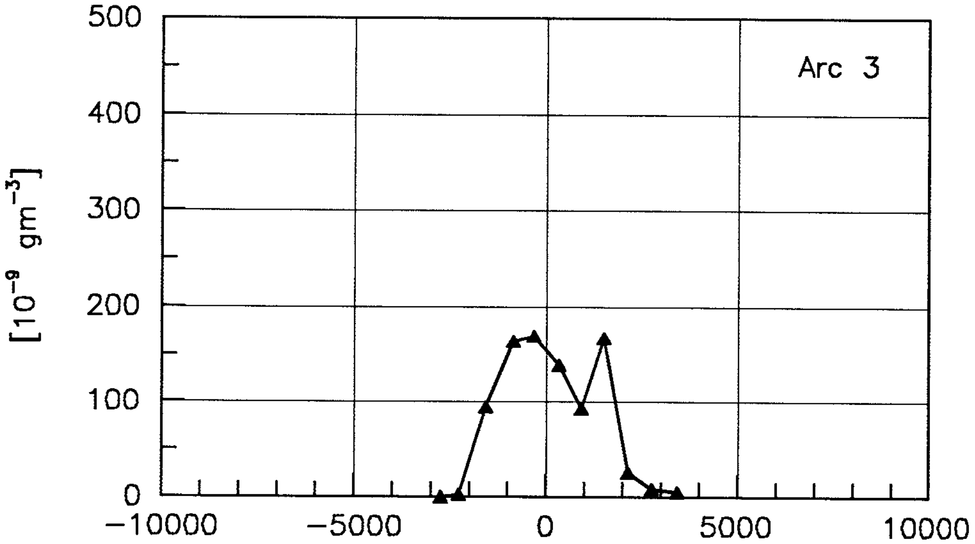


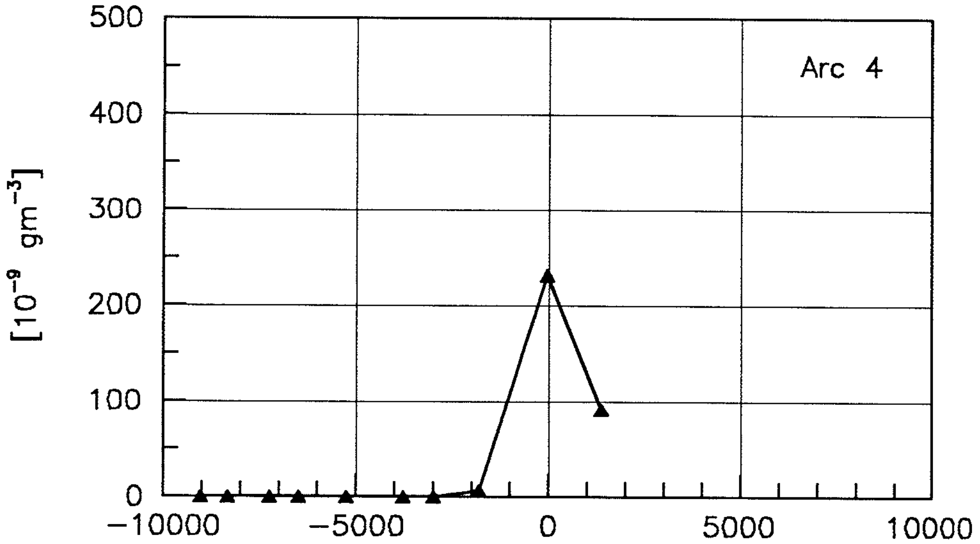
Figure 35. Tracer experiment on June 4. The sampling sites of APL (△), SCK (•) and NILU (■) are indicated (Figure 22). The tracer release point is also indicated (⊙).

Figure 36. Tracer concentrations (nano-grammes of SF_6 per cubic-metre) averaged over one hour versus cross-wind distance – on June 4




Arc 2
[10⁻⁹ gm⁻³]
500
400
300
200
100
0
−10000
−5000
0
5000
10000


Arc 3
[10⁻⁹ gm⁻³]
500
400
300
200
100
0
−10000
−5000
0
5000
10000


Arc 4
[10⁻⁹ gm⁻³]
500
400
300
200
100
0
−10000
−5000
0
5000
10000

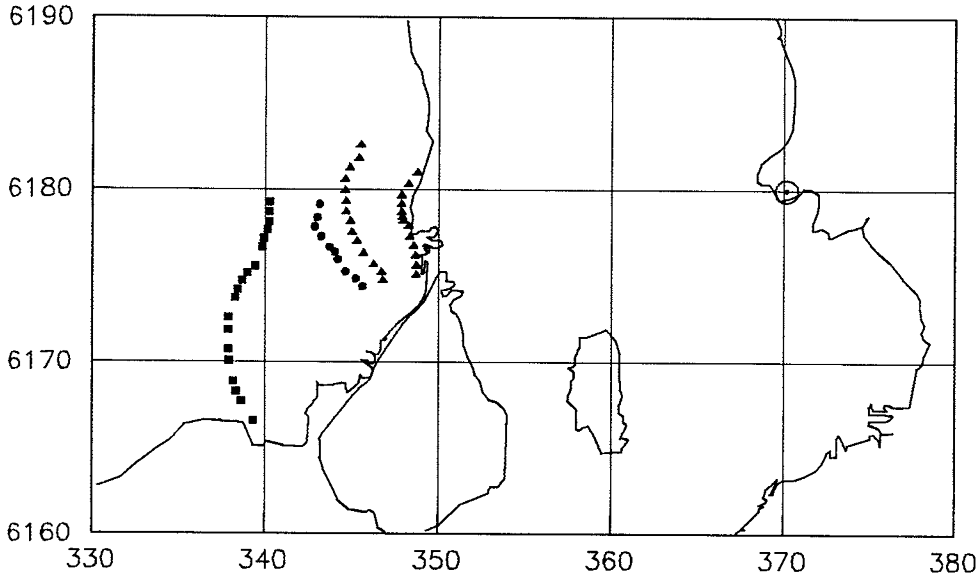
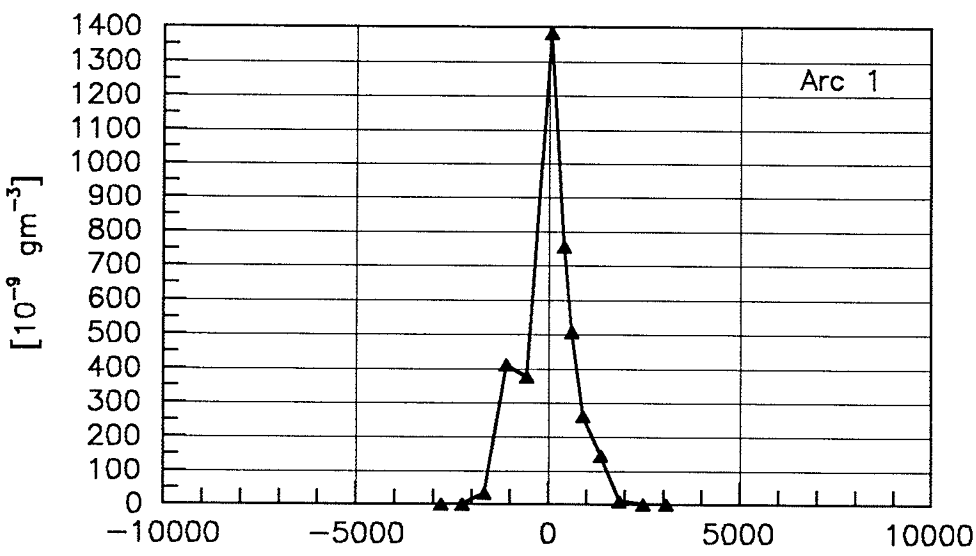
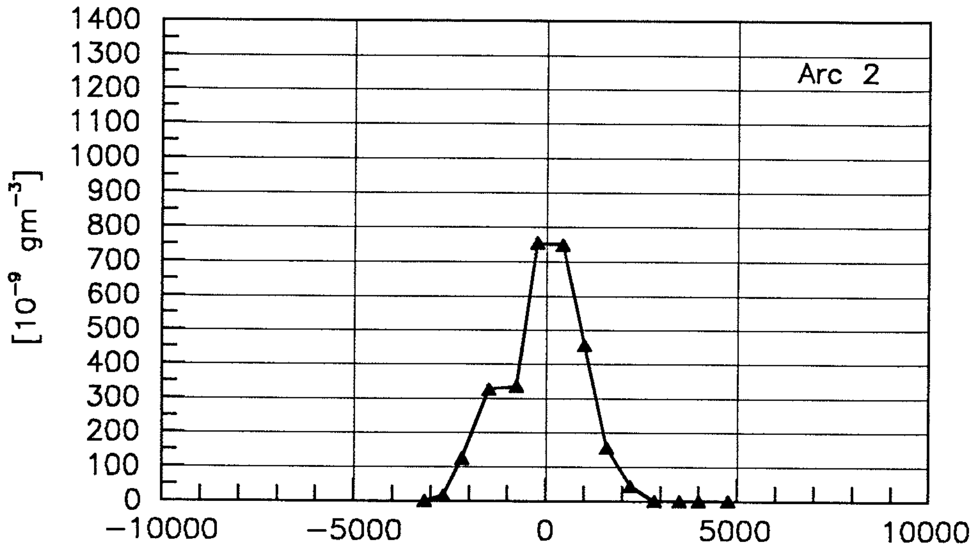
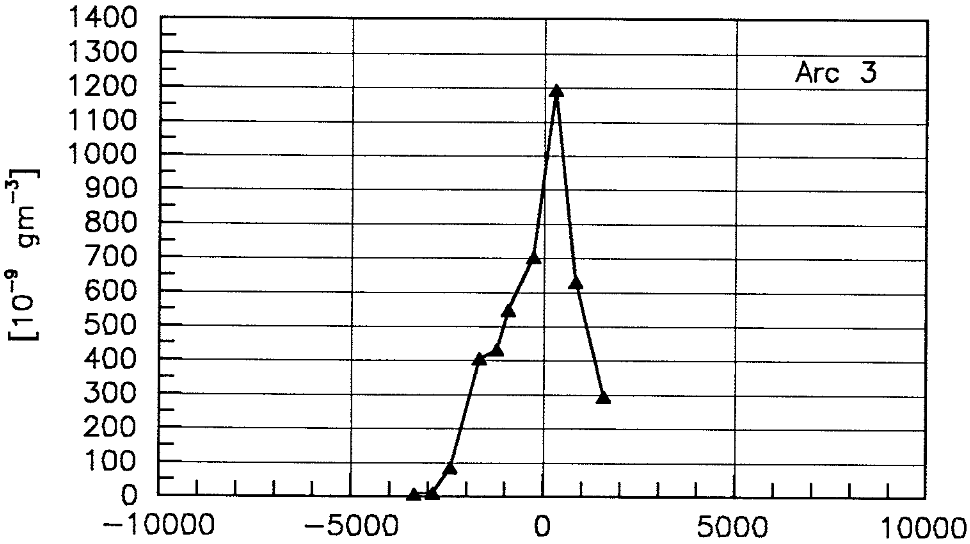


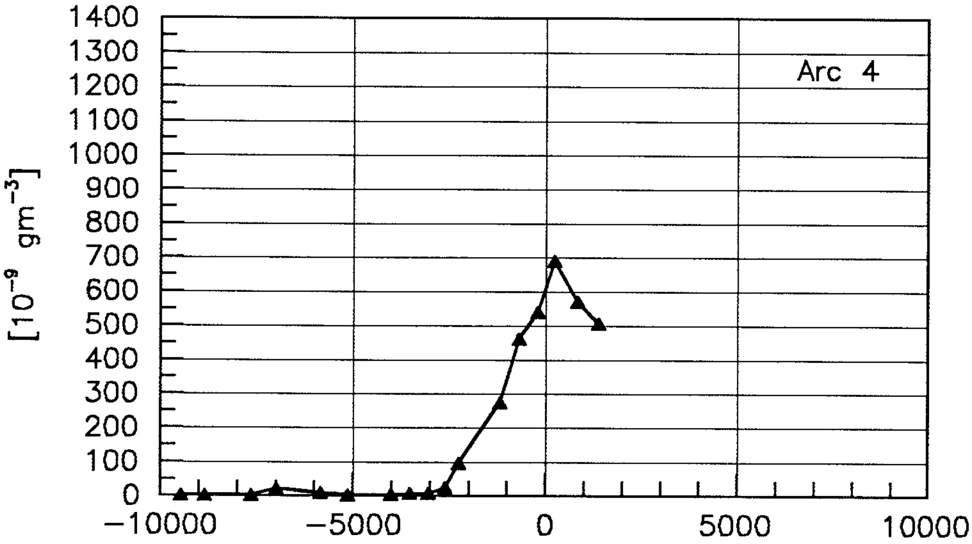
Figure 37. Tracer experiment on June 5. The sampling sites of APL (△), SCK (•) and NILU (▪) are indicated (Figure 22). The tracer release point is also indicated (⊙).

Figure 38. Tracer concentrations (nano-grammes of SF_6 per cubic-metre) averaged over one hour versus cross-wind distance – on June 5




Arc 2
[10⁻⁹ gm⁻³]
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
−10000
−5000
0
5000
10000


Arc 3
[10⁻⁹ gm⁻³]
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
−10000
−5000
0
5000
10000


Arc 4
[10⁻⁹ gm⁻³]
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
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100
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−10000
−5000
0
5000
10000

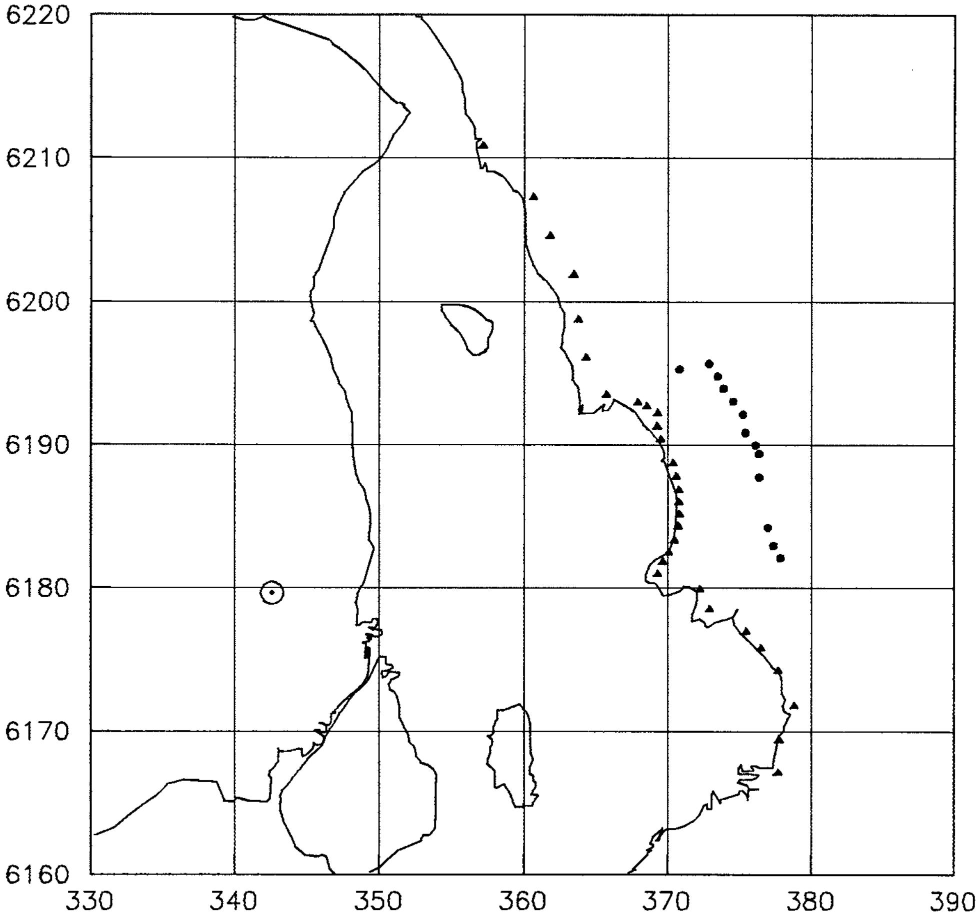


Figure 39. Tracer experiment on June 12. The sampling sites of APL (△), SCK (•) and NILU (▪) are indicated (Figure 22). The tracer release point is also indicated (⊙).

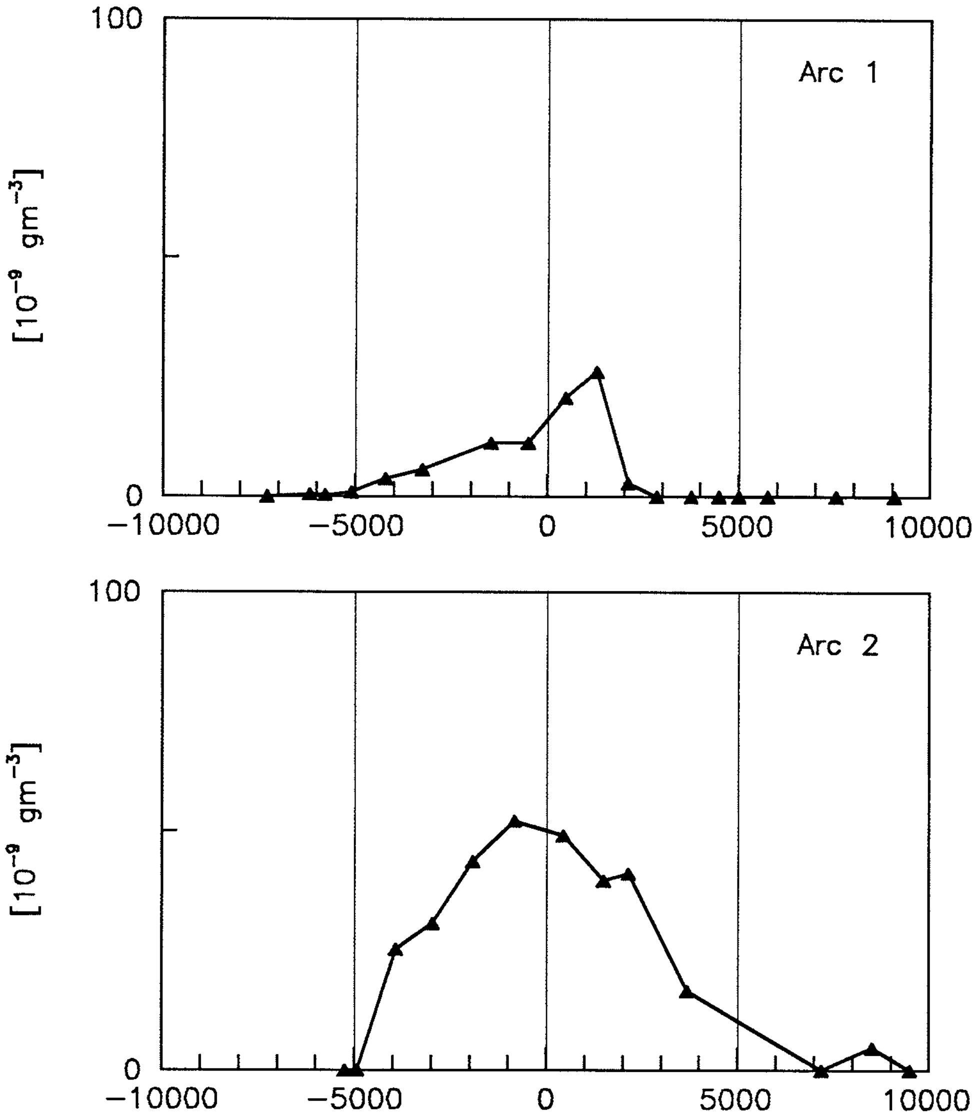


Figure 40. Tracer concentrations (nano-grammes of SF_6 per cubic-metre) averaged over one hour versus cross-wind distance – on June 12.

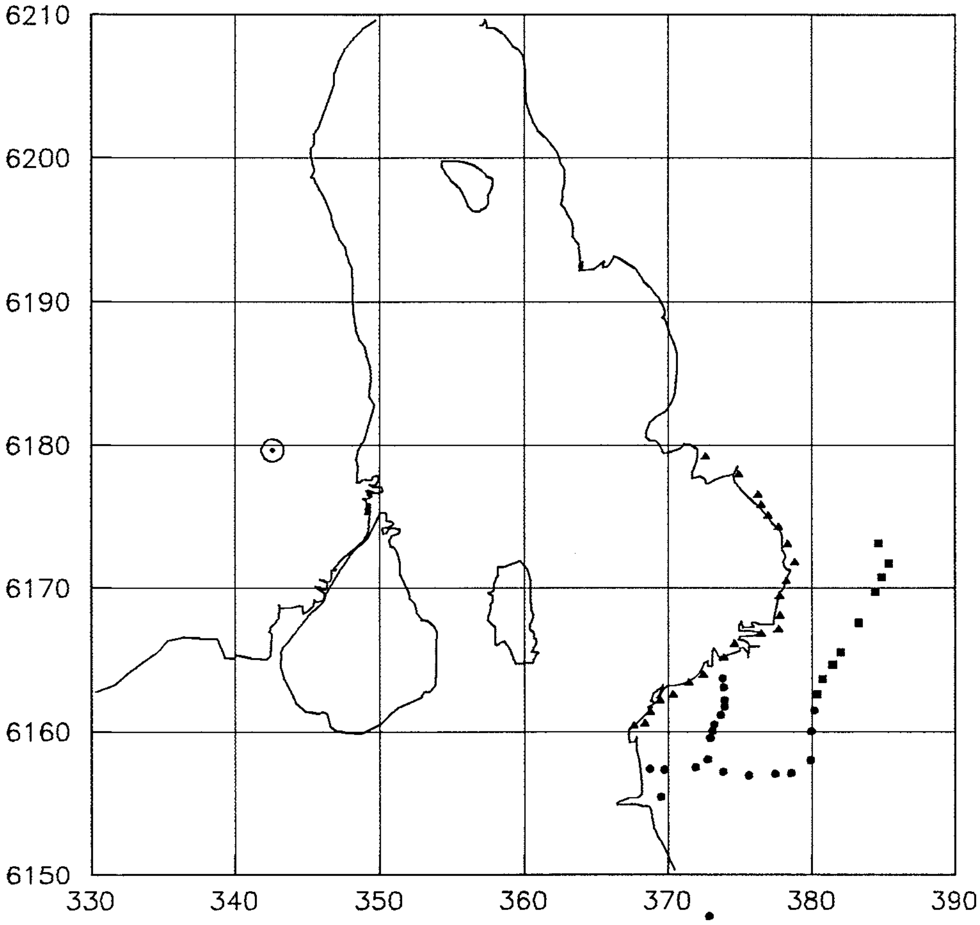


Figure 41. Tracer experiment on June 14. The sampling sites of APL (△), SCK (•) and NILU (▪) are indicated (Figure 22). The tracer release point is also indicated (⊙).

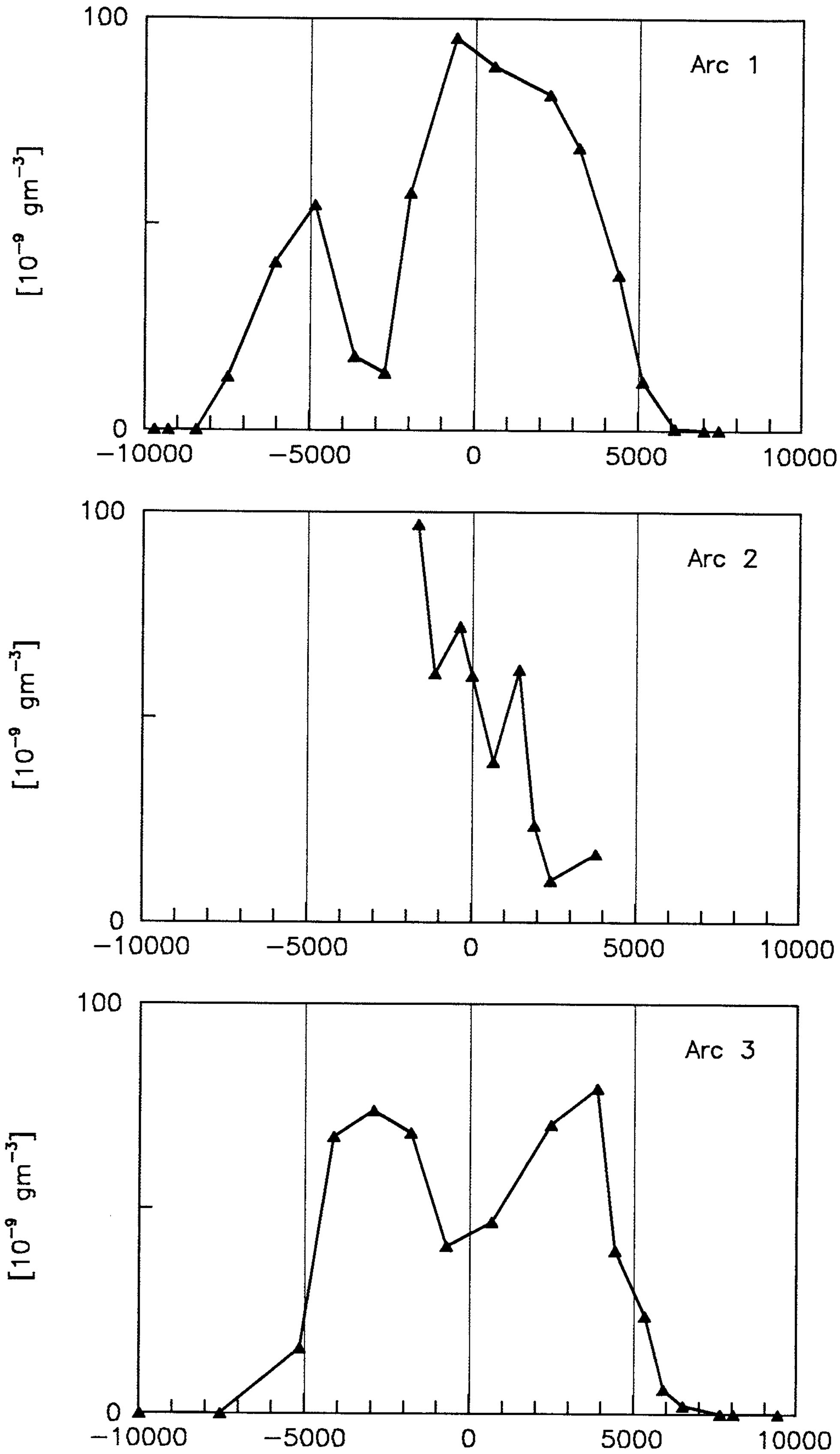
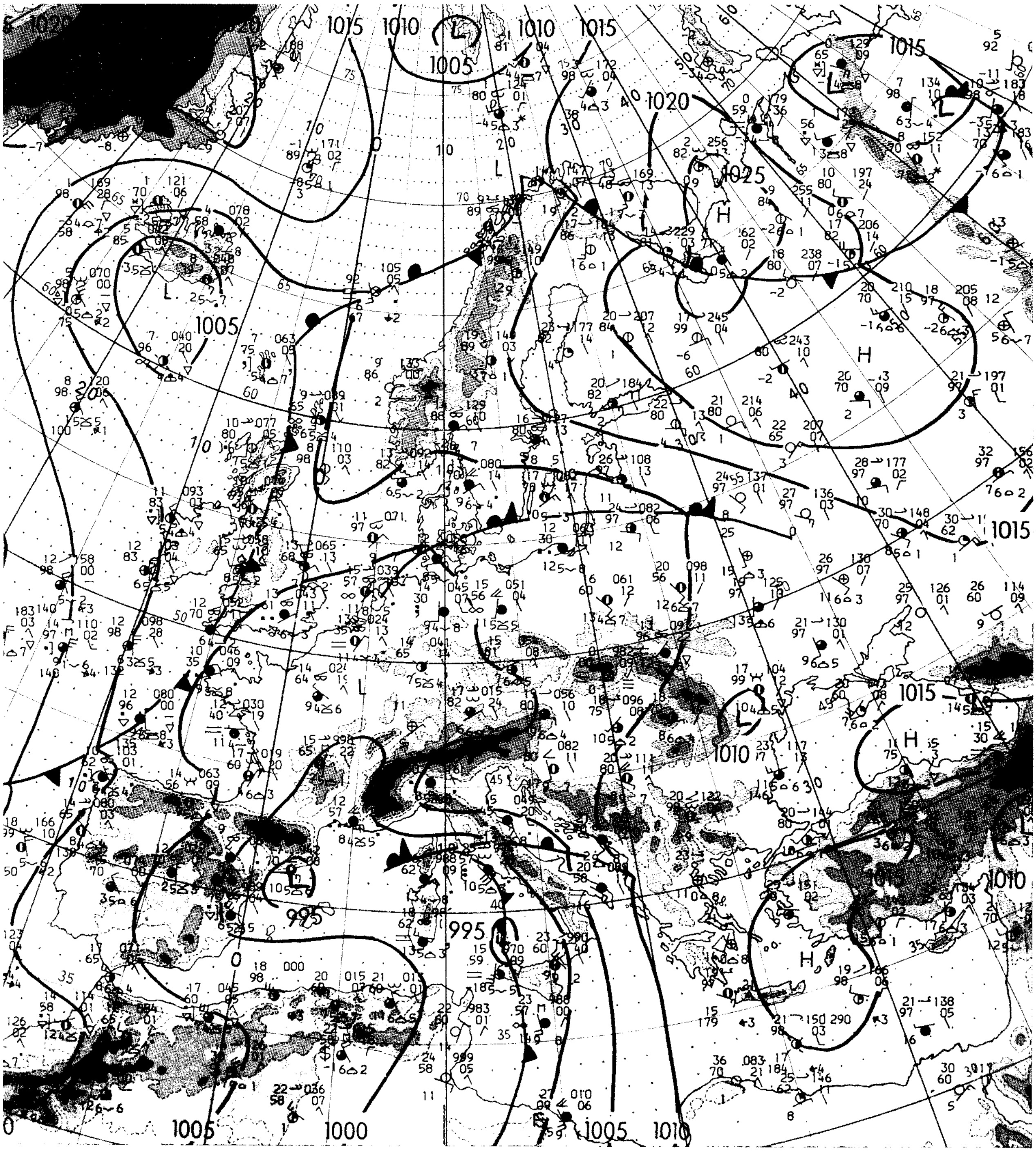


Figure 42. Tracer concentrations (nano-grammes of SF_6 per cubic-metre) averaged over one hour versus cross-wind distance – on June 14.

5 Daily weather maps

The weather maps in this section are reproduced from the "12 GMT Surface Chart" of the *Europäischer Wetterbericht* (1984, Vol. 9, No. 136–166) which is published by the Deutscher Wetterdienst. The scale is approximately 1:30 000 000.

Figure 43. Surface chart at 1300 CET on May 15, 1984.



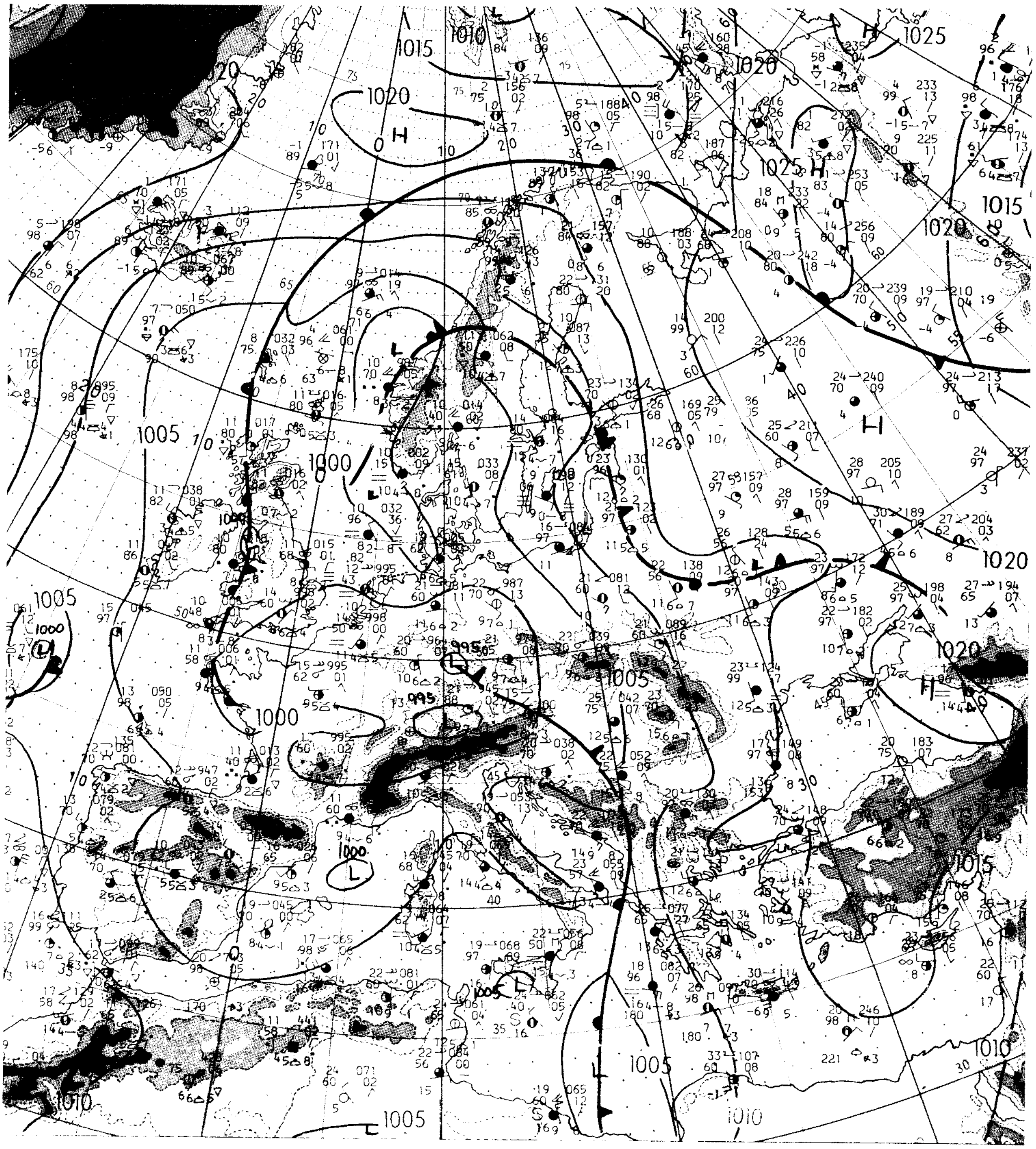


Figure 44. Surface chart at 1300 CET on May 16, 1984.

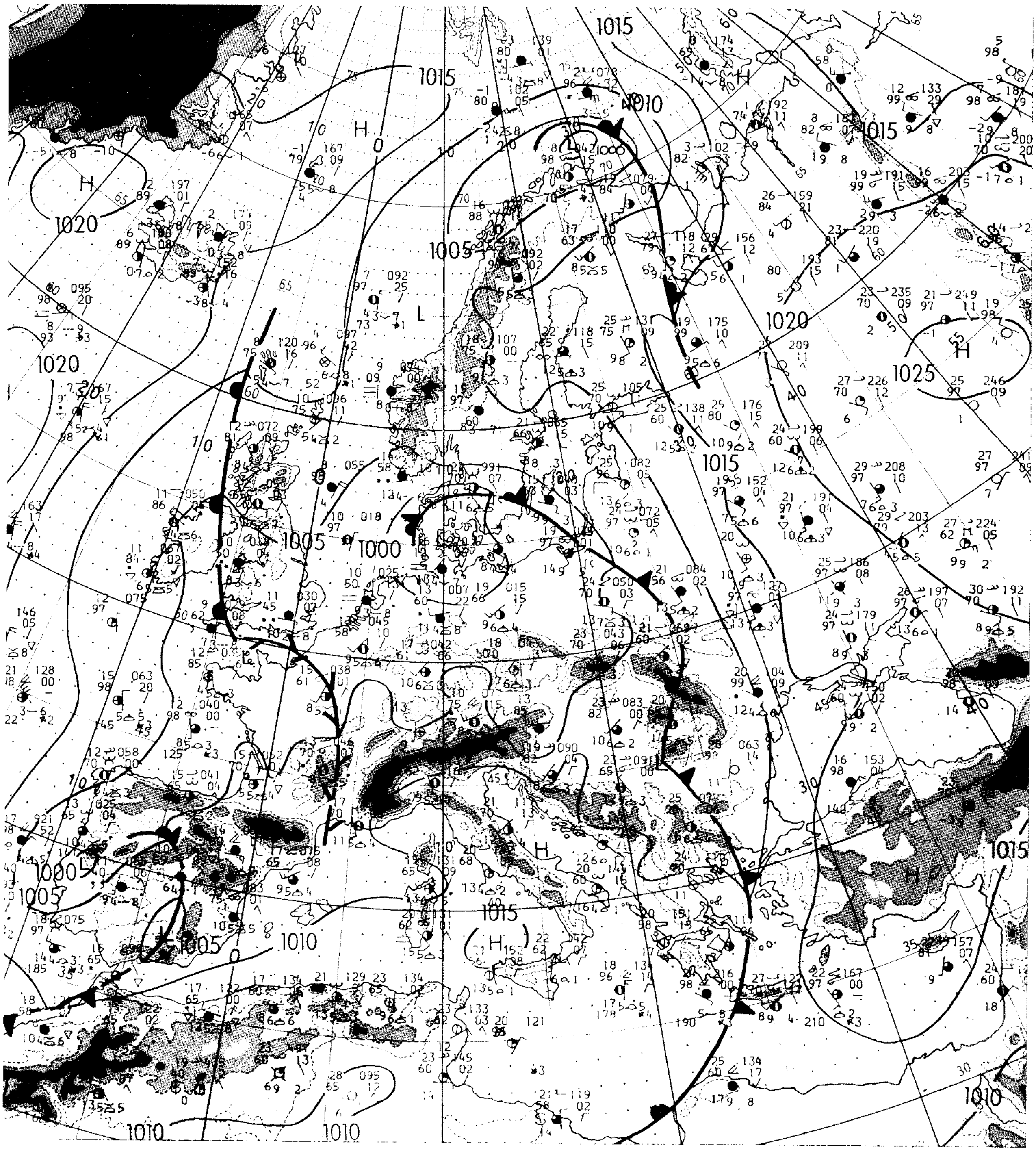


Figure 45. Surface chart at 1300 CET on May 17, 1984.

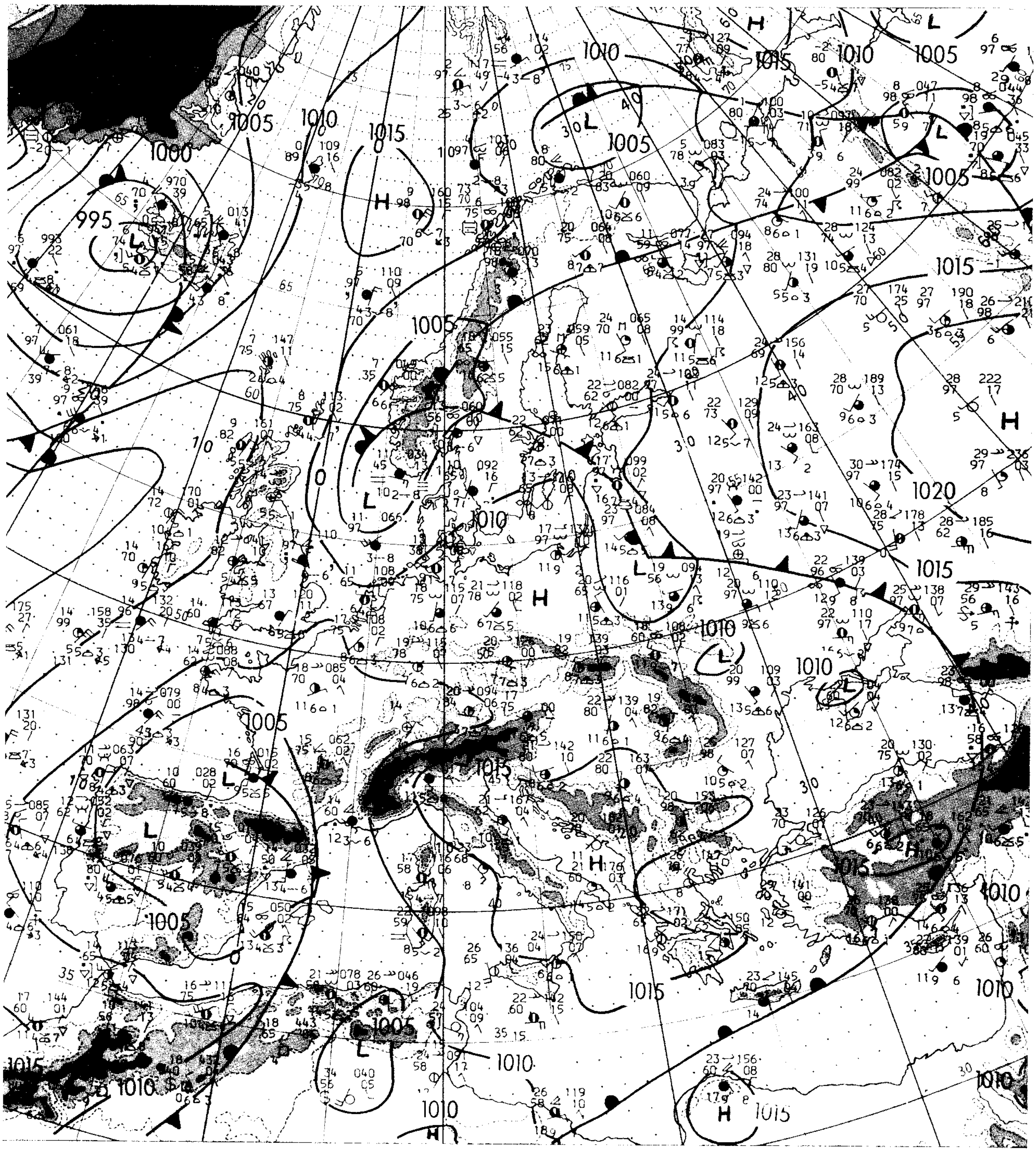


Figure 46. Surface chart at 1300 CET on May 18, 1984.

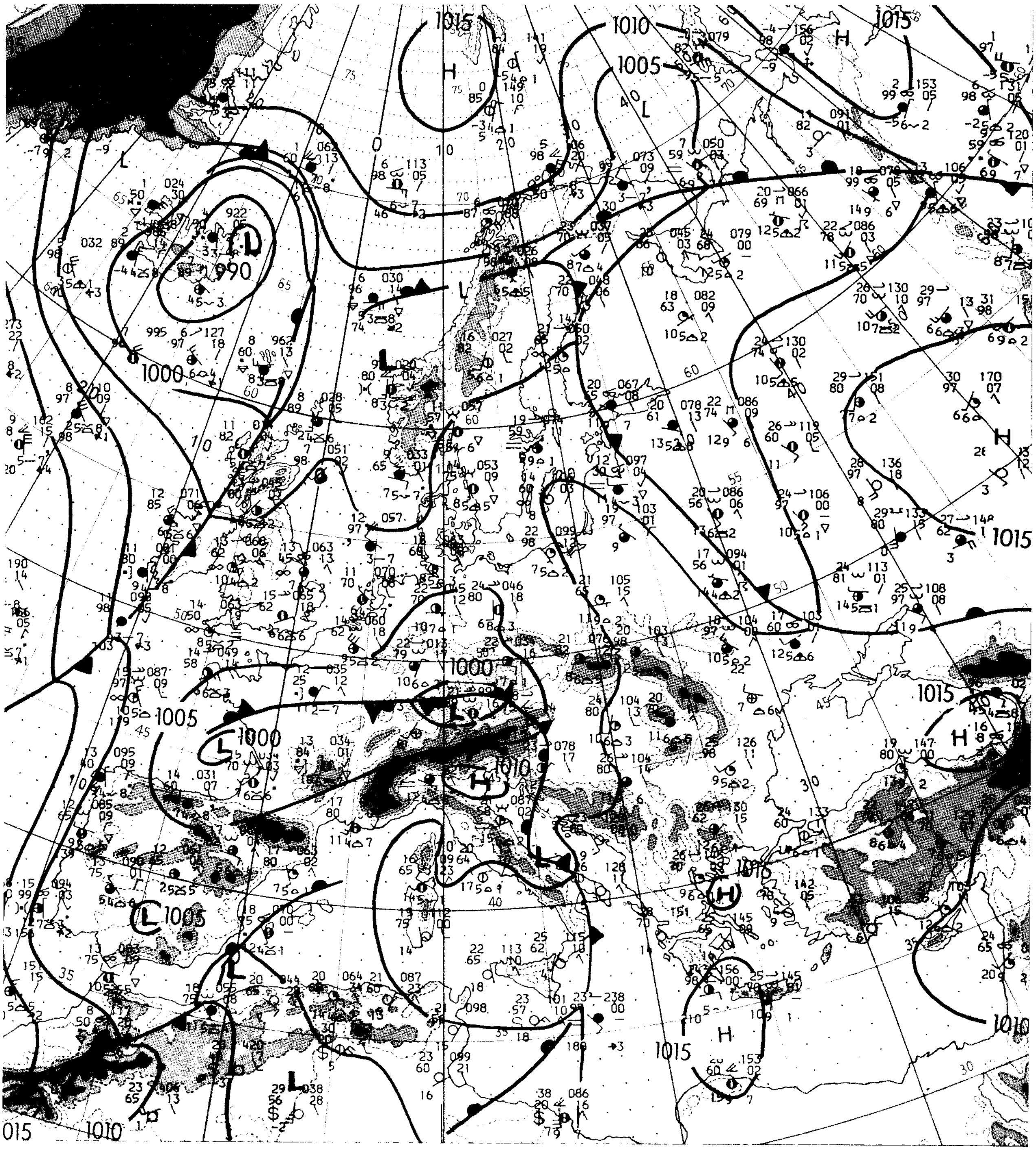


Figure 47. Surface chart at 1300 CET on May 19, 1984.

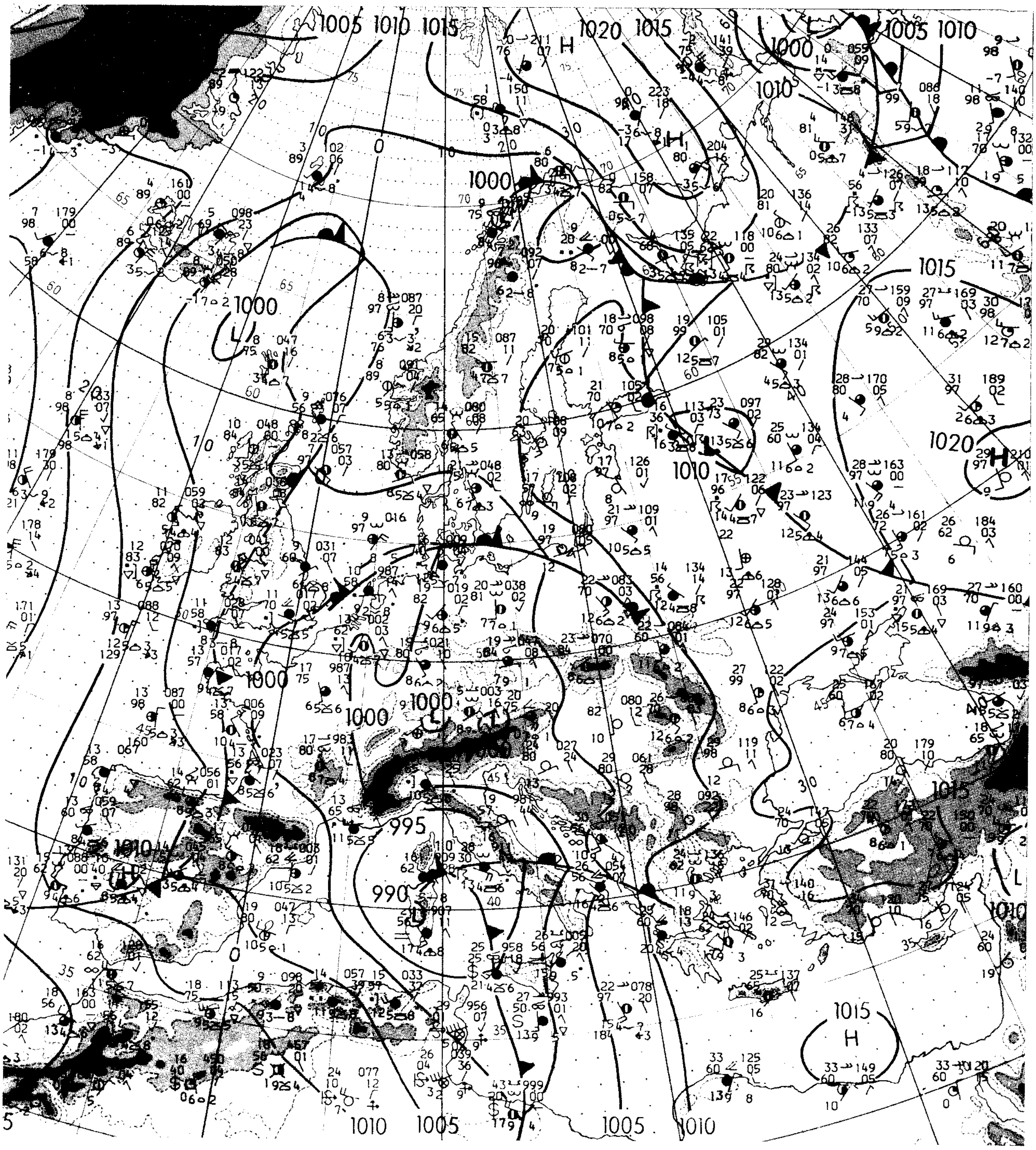


Figure 48. Surface chart at 1300 CET on May 20, 1984.

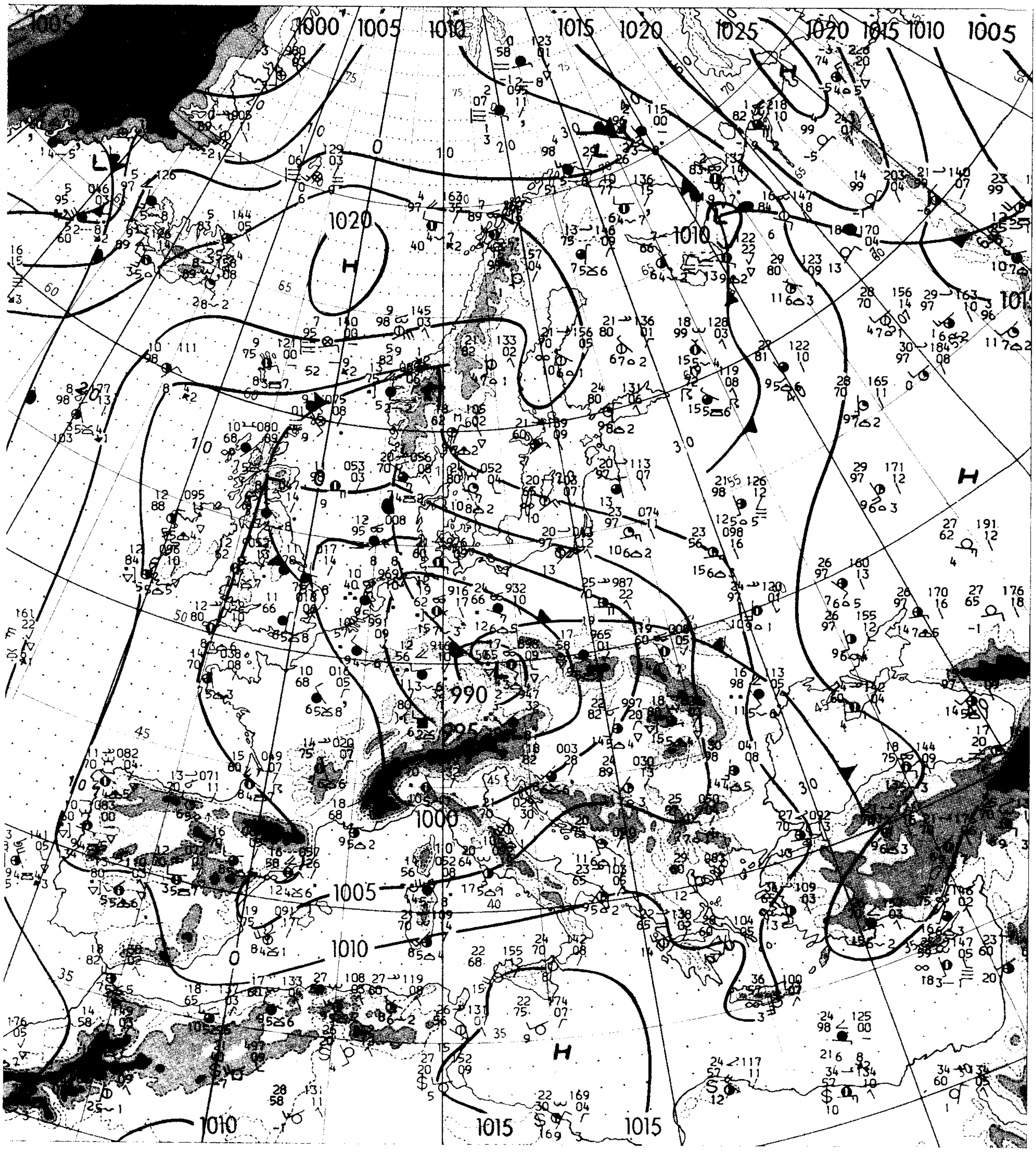


Figure 49. Surface chart at 1300 CET on May 21, 1984.

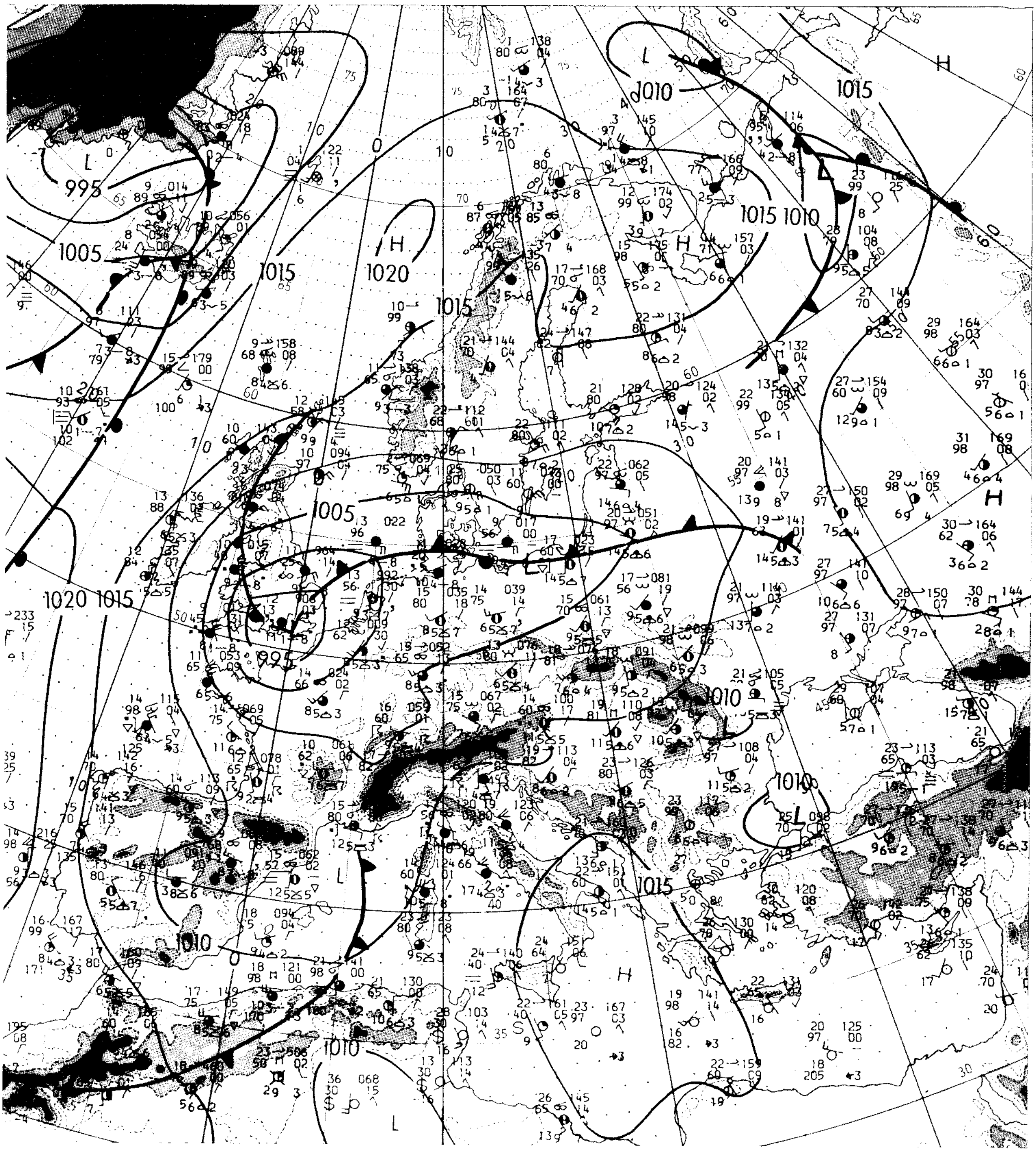


Figure 50. Surface chart at 1300 CET on May 22, 1984.

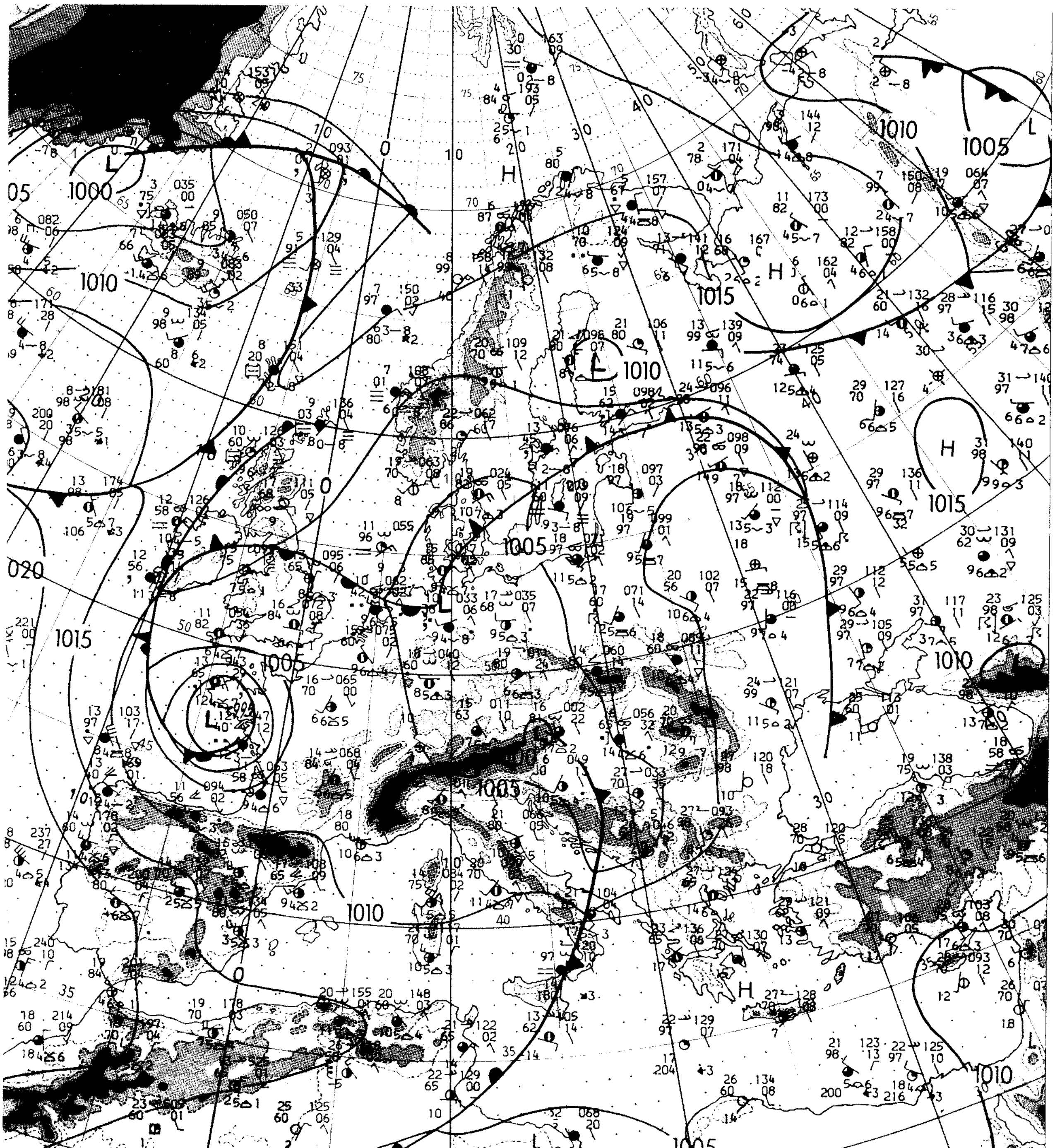


Figure 51. Surface chart at 1300 CET on May 23, 1984.

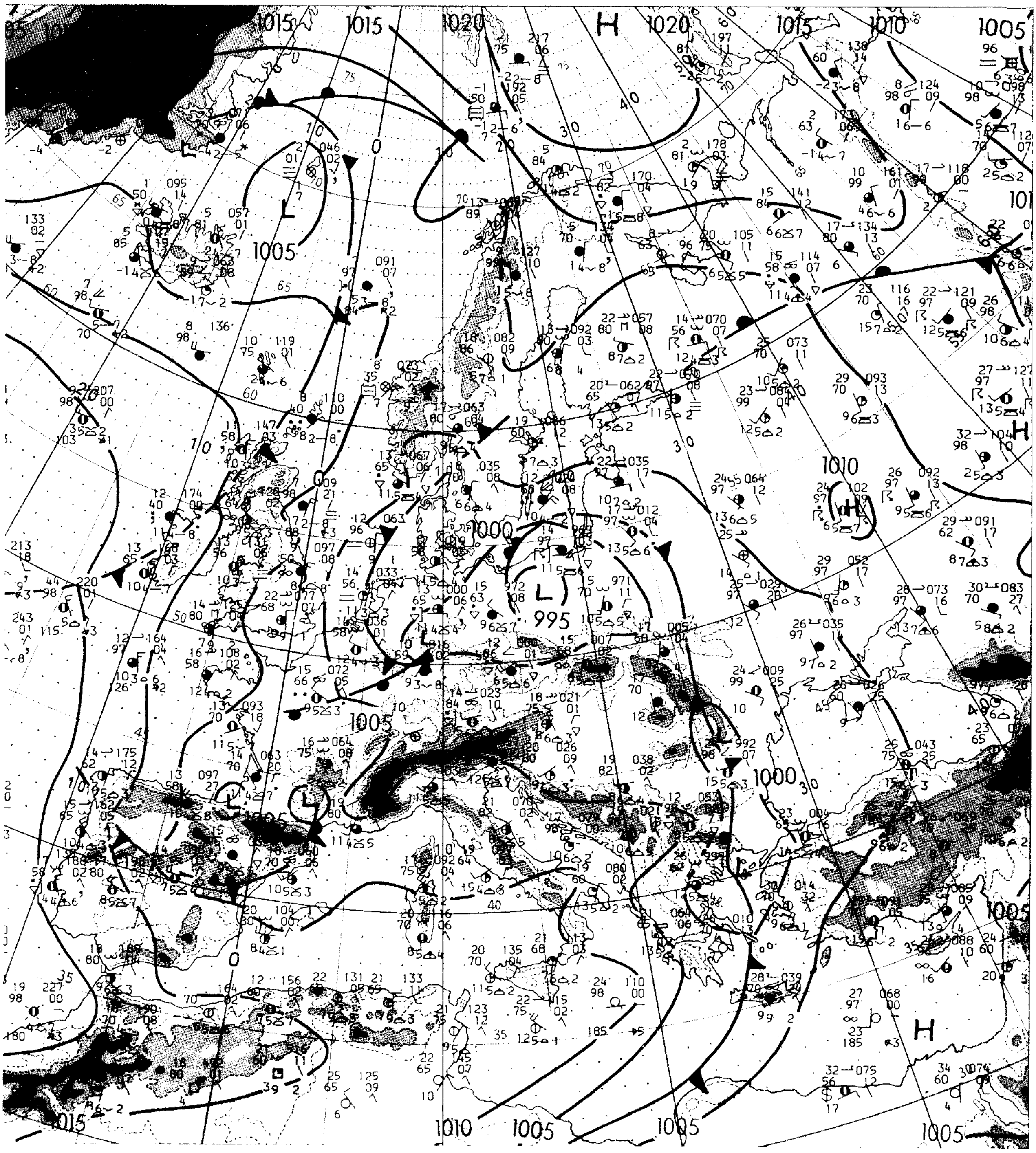


Figure 52. Surface chart at 1300 CET on May 24, 1984.

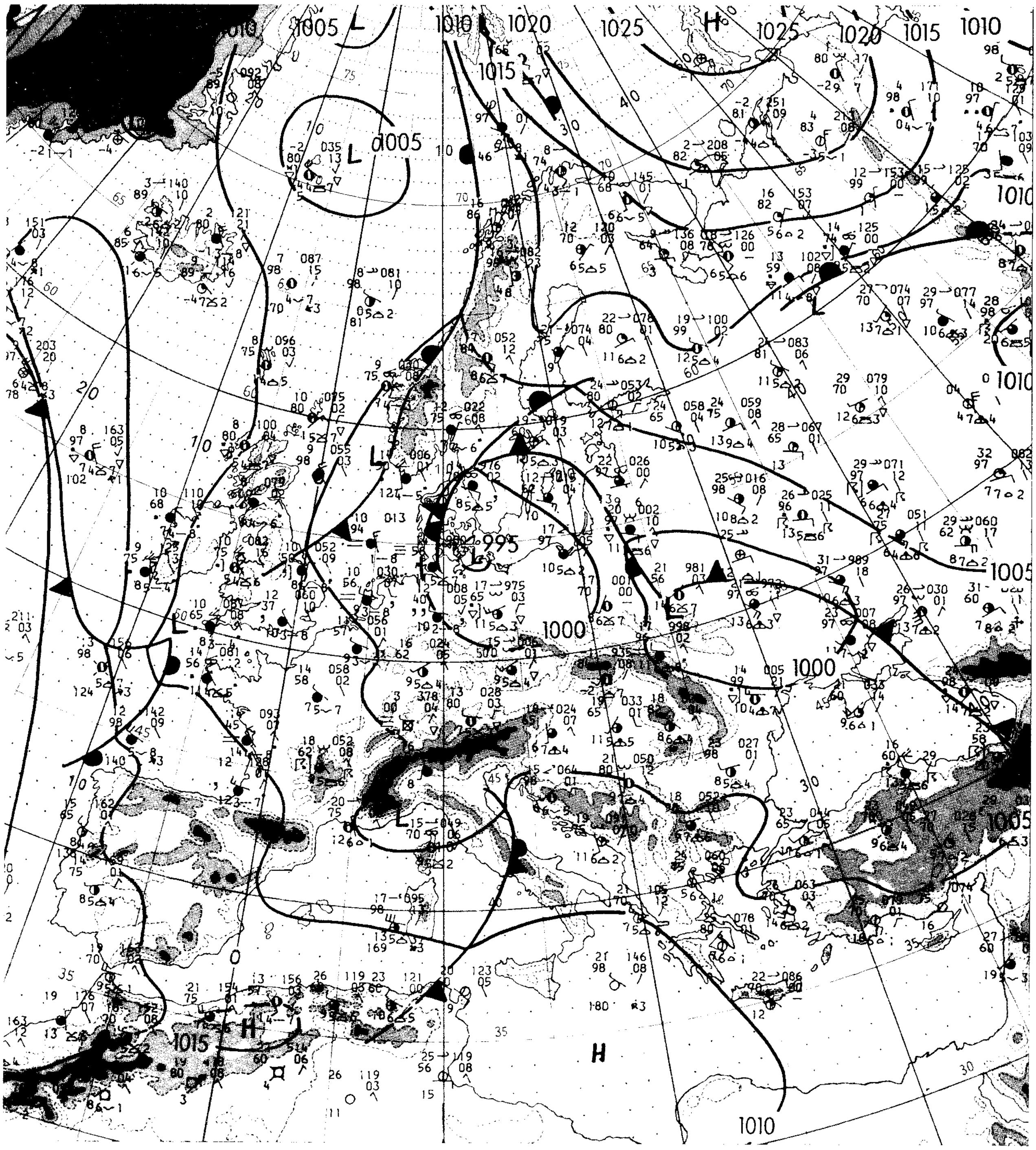


Figure 53. Surface chart at 1300 CET on May 25, 1984.

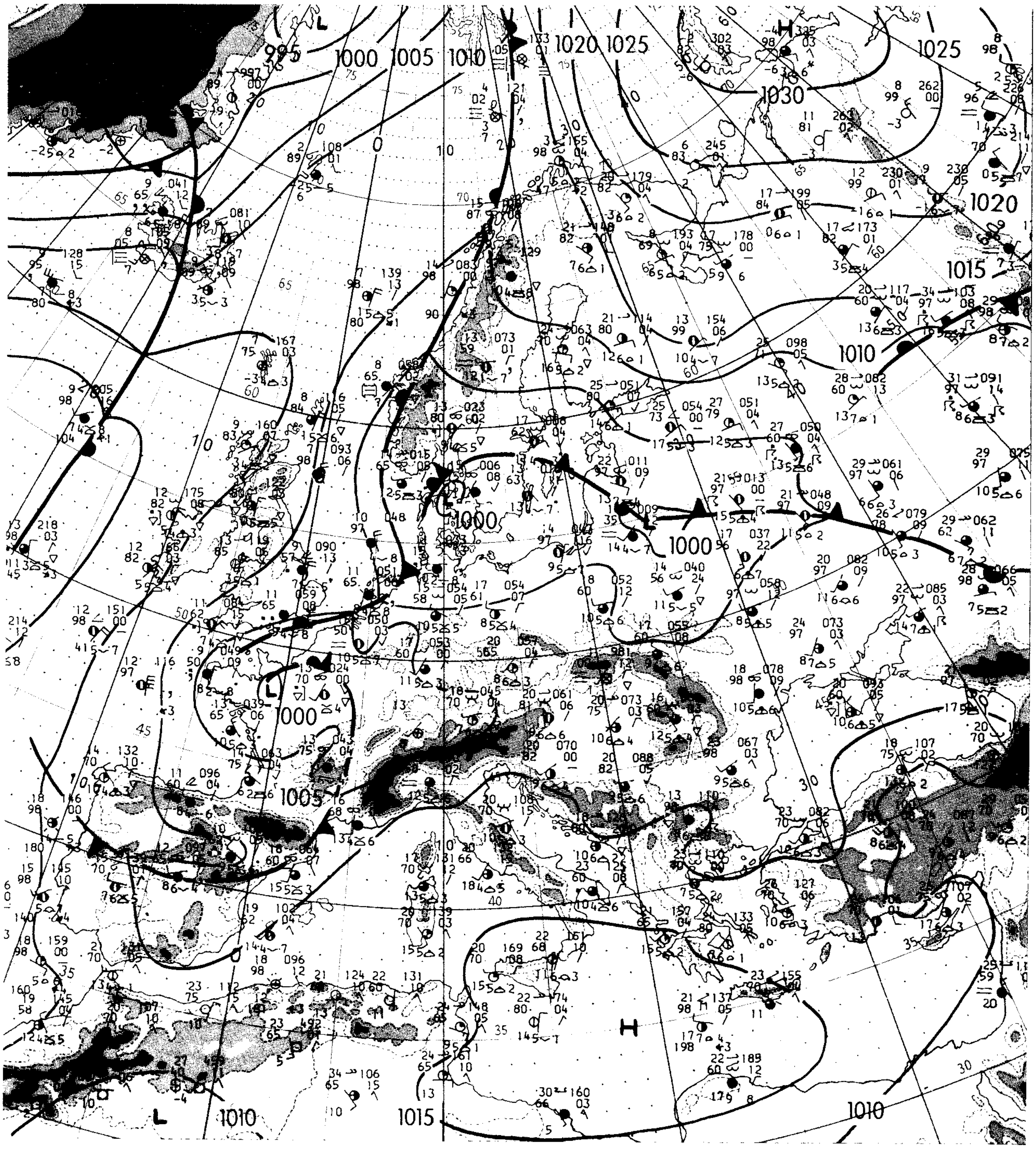


Figure 54. Surface chart at 1300 CET on May 26, 1984.

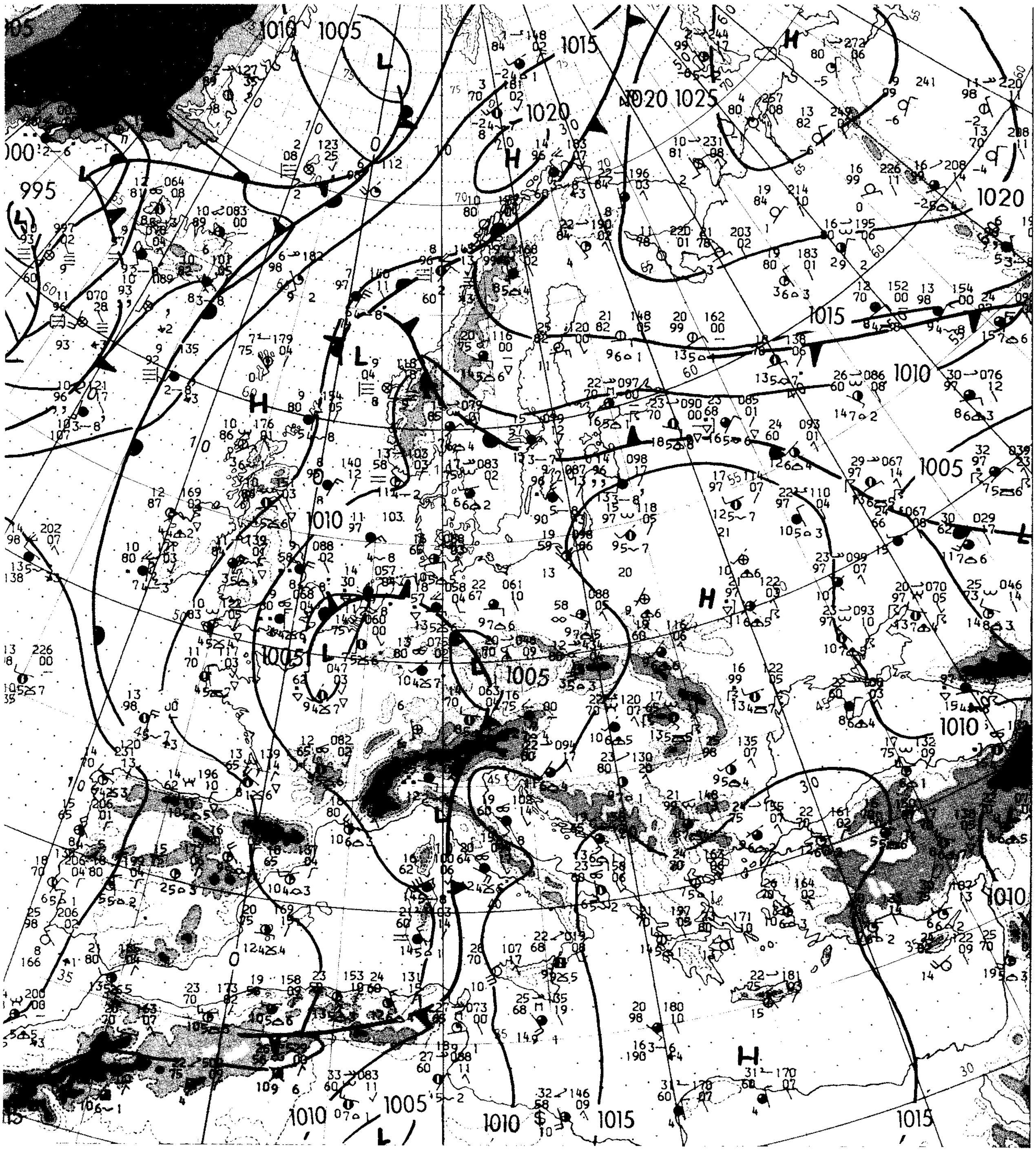


Figure 55. Surface chart at 1300 CET on May 27, 1984.

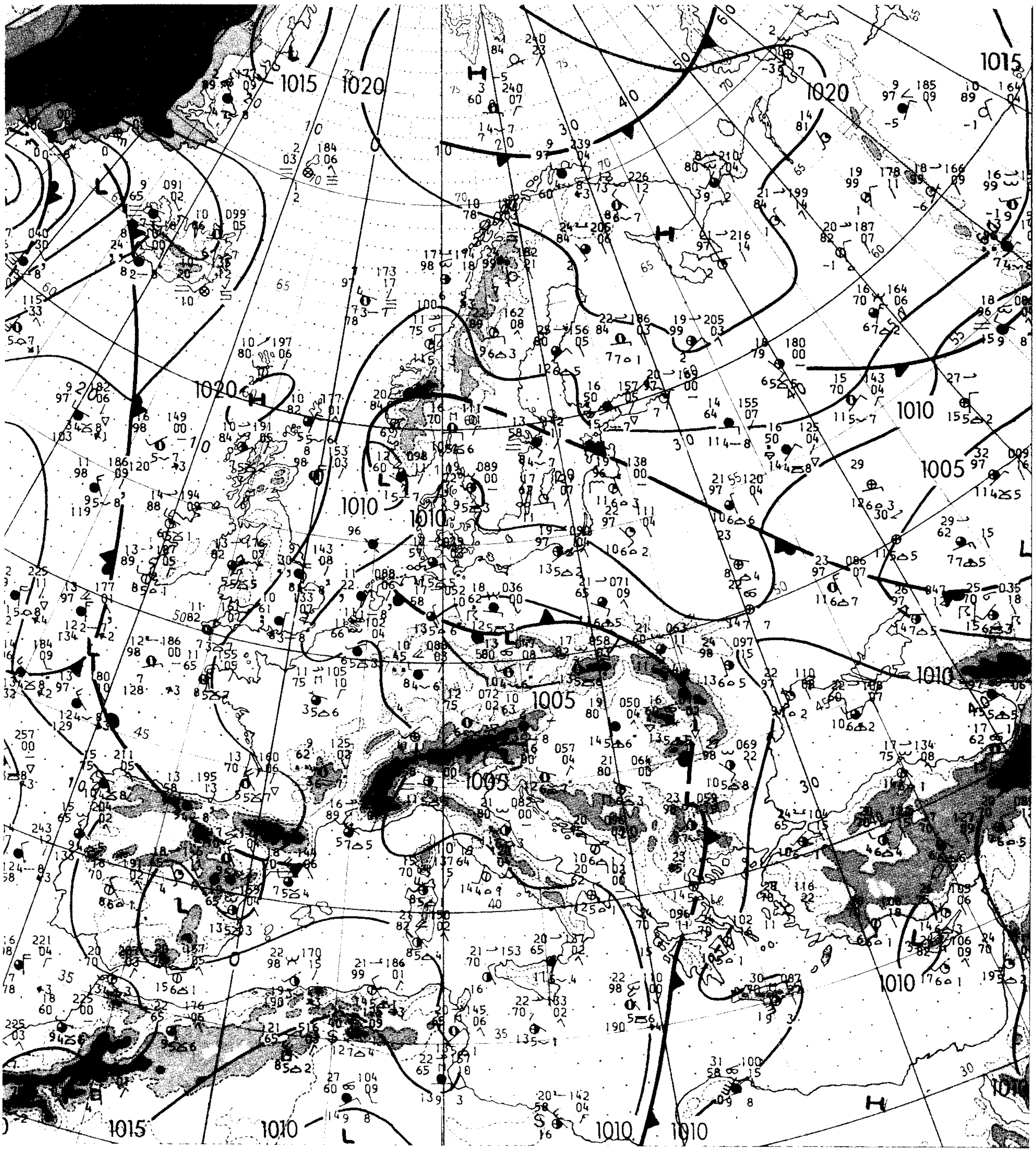


Figure 56. Surface chart at 1300 CET on May 28, 1984.

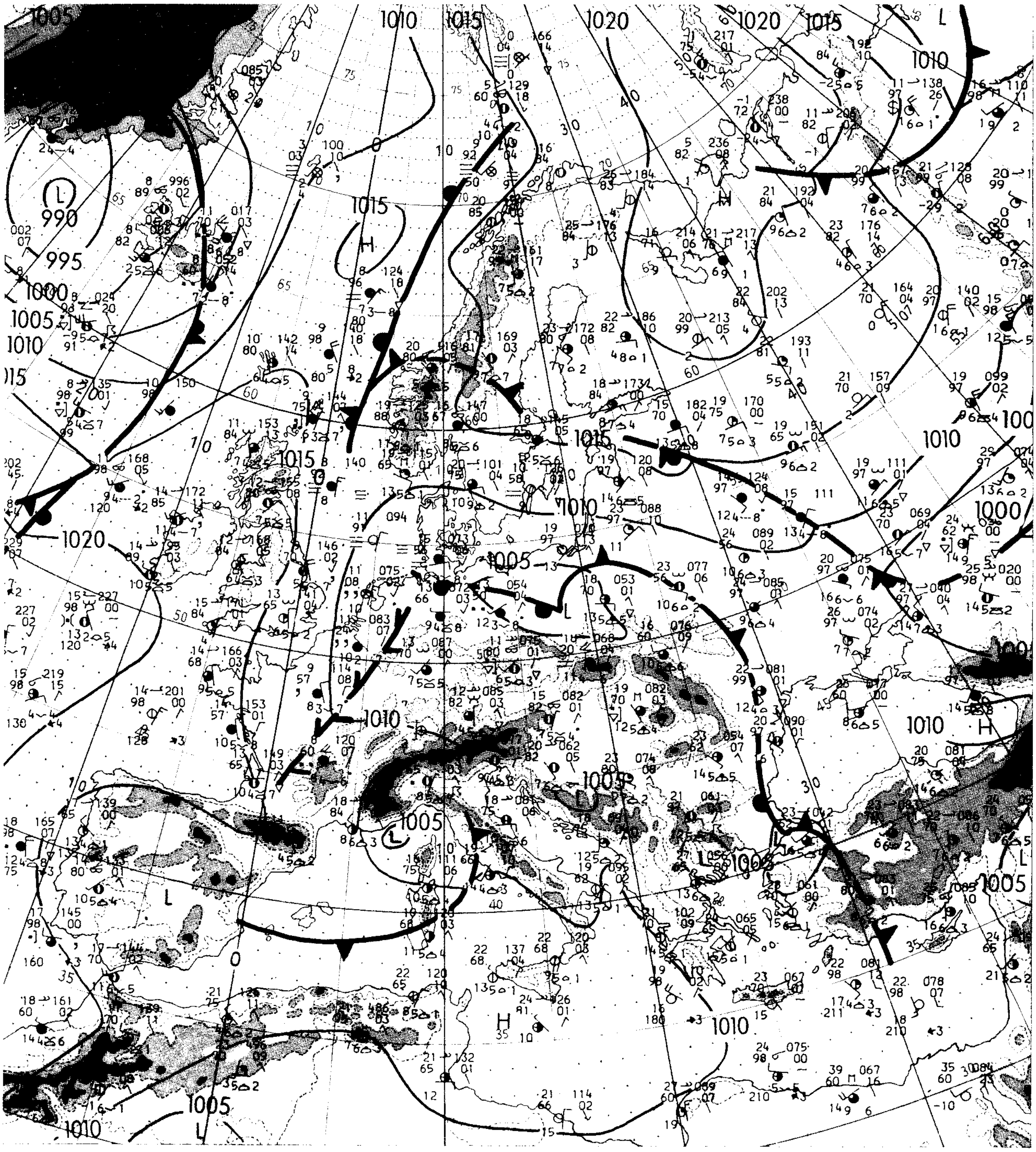


Figure 57. Surface chart at 1300 CET on May 29, 1984.

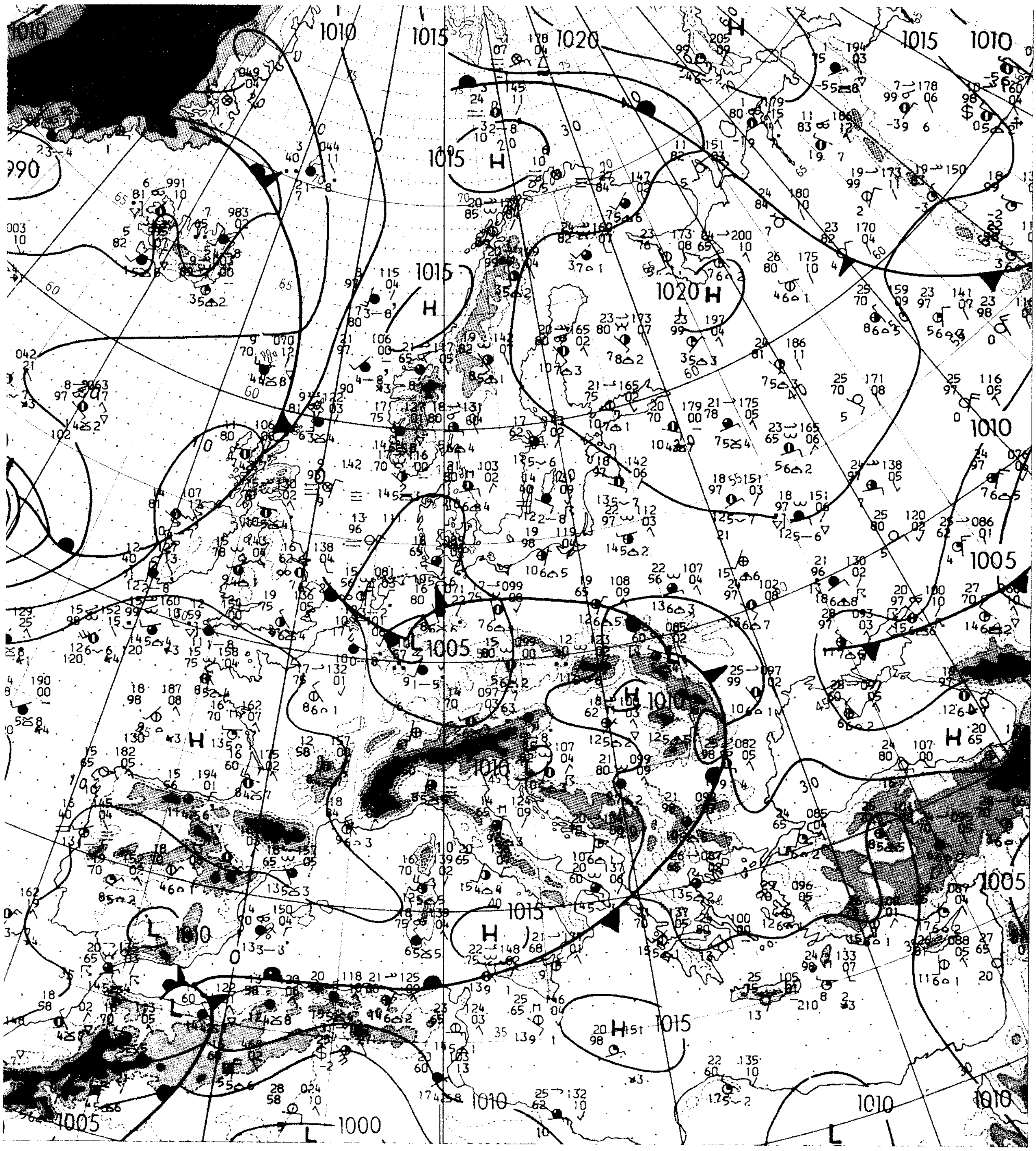


Figure 58. Surface chart at 1300 CET on May 30, 1984.

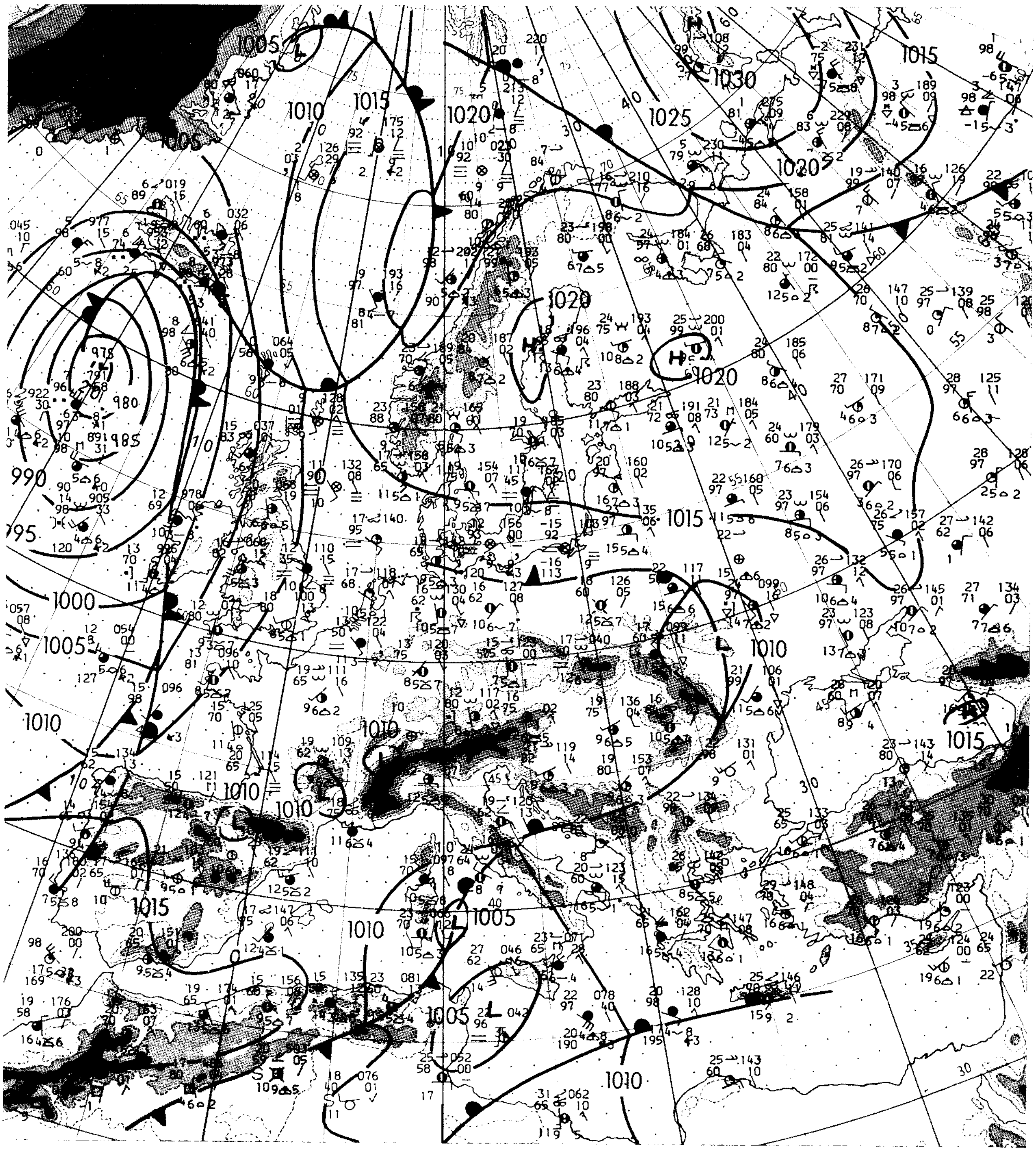


Figure 59. Surface chart at 1300 CET on May 31, 1984.

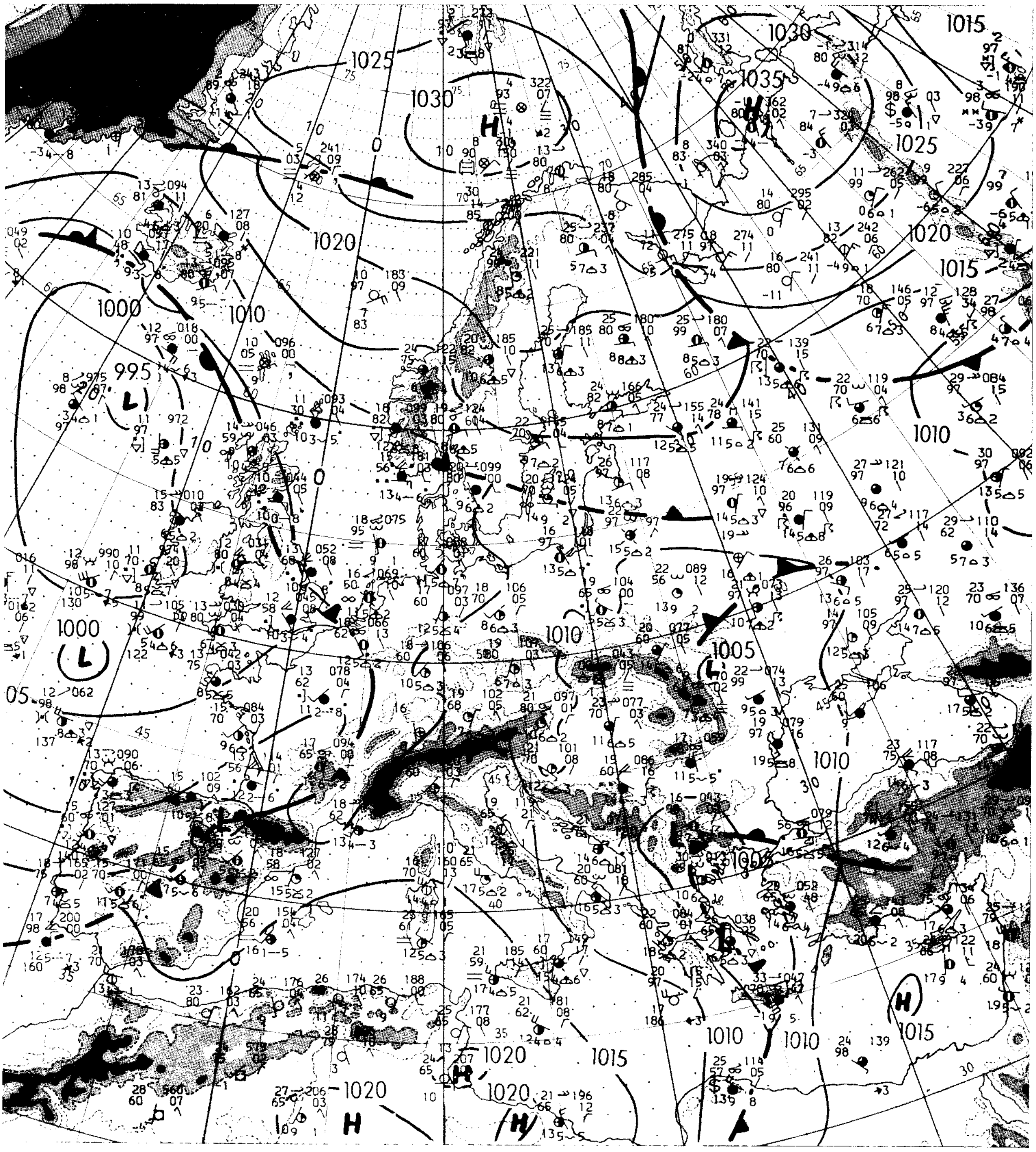


Figure 60. Surface chart at 1300 CET on June 1, 1984.

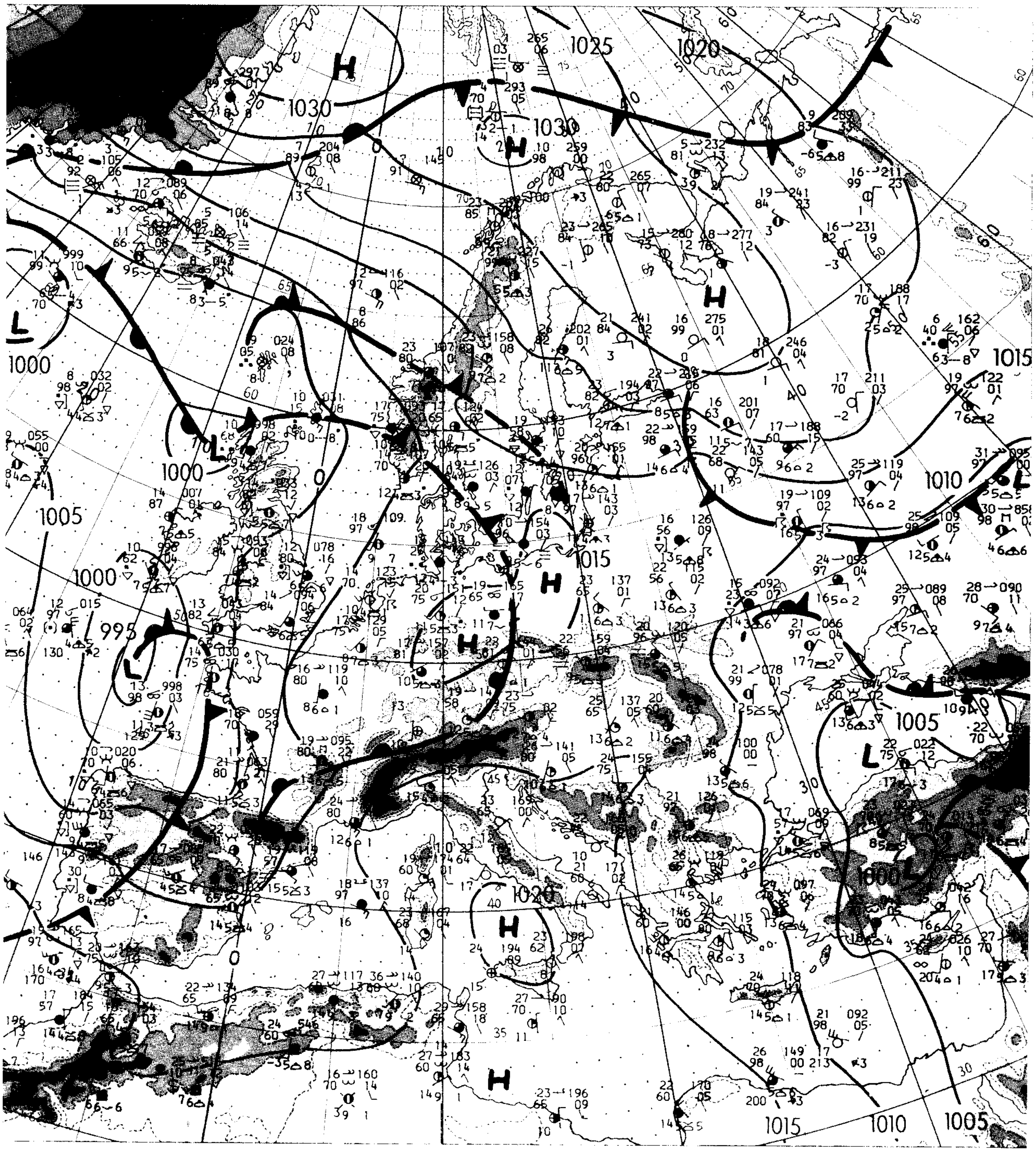


Figure 61. Surface chart at 1300 CET on June 2, 1984.

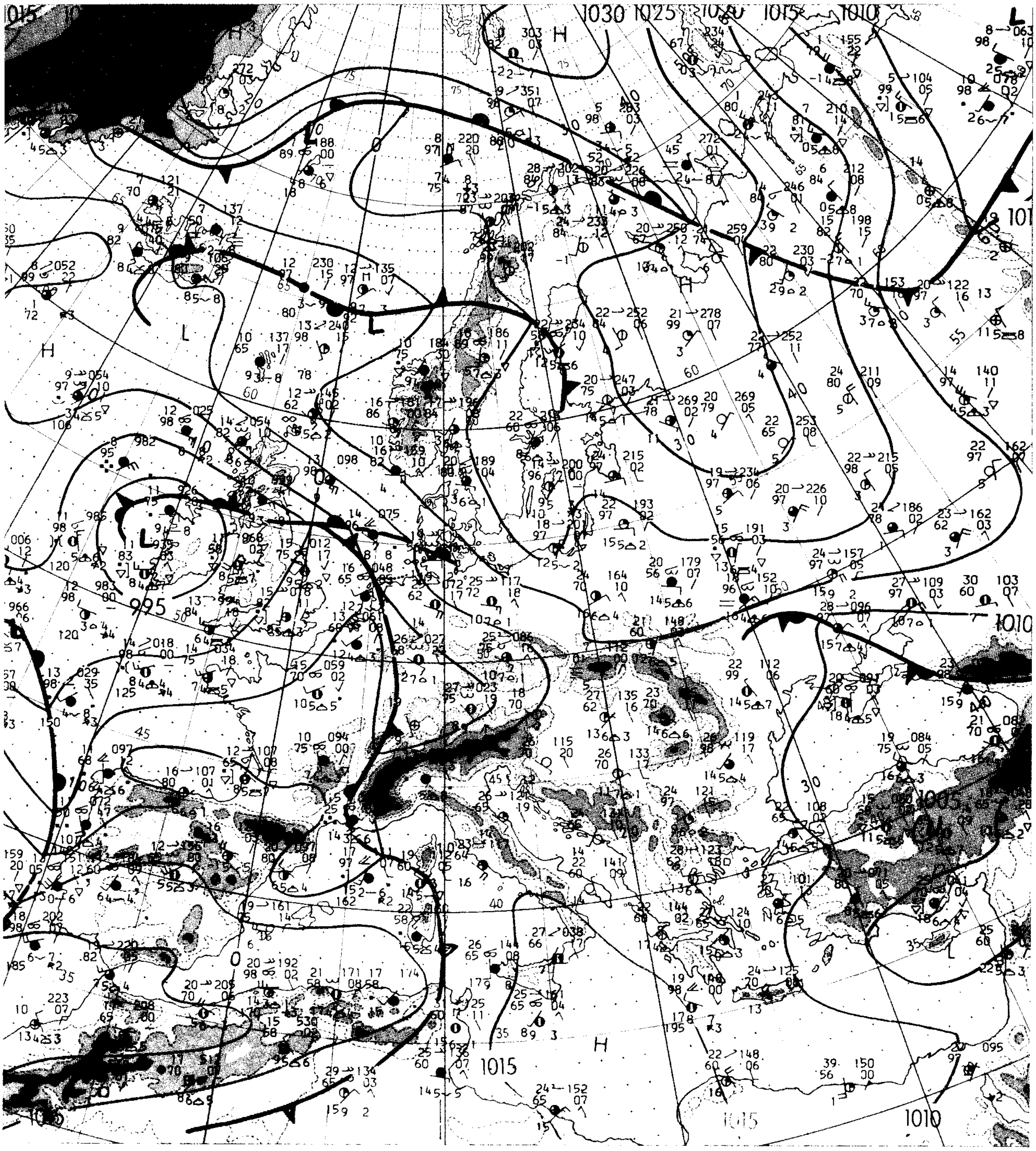


Figure 62. Surface chart at 1300 CET on June 3, 1984.

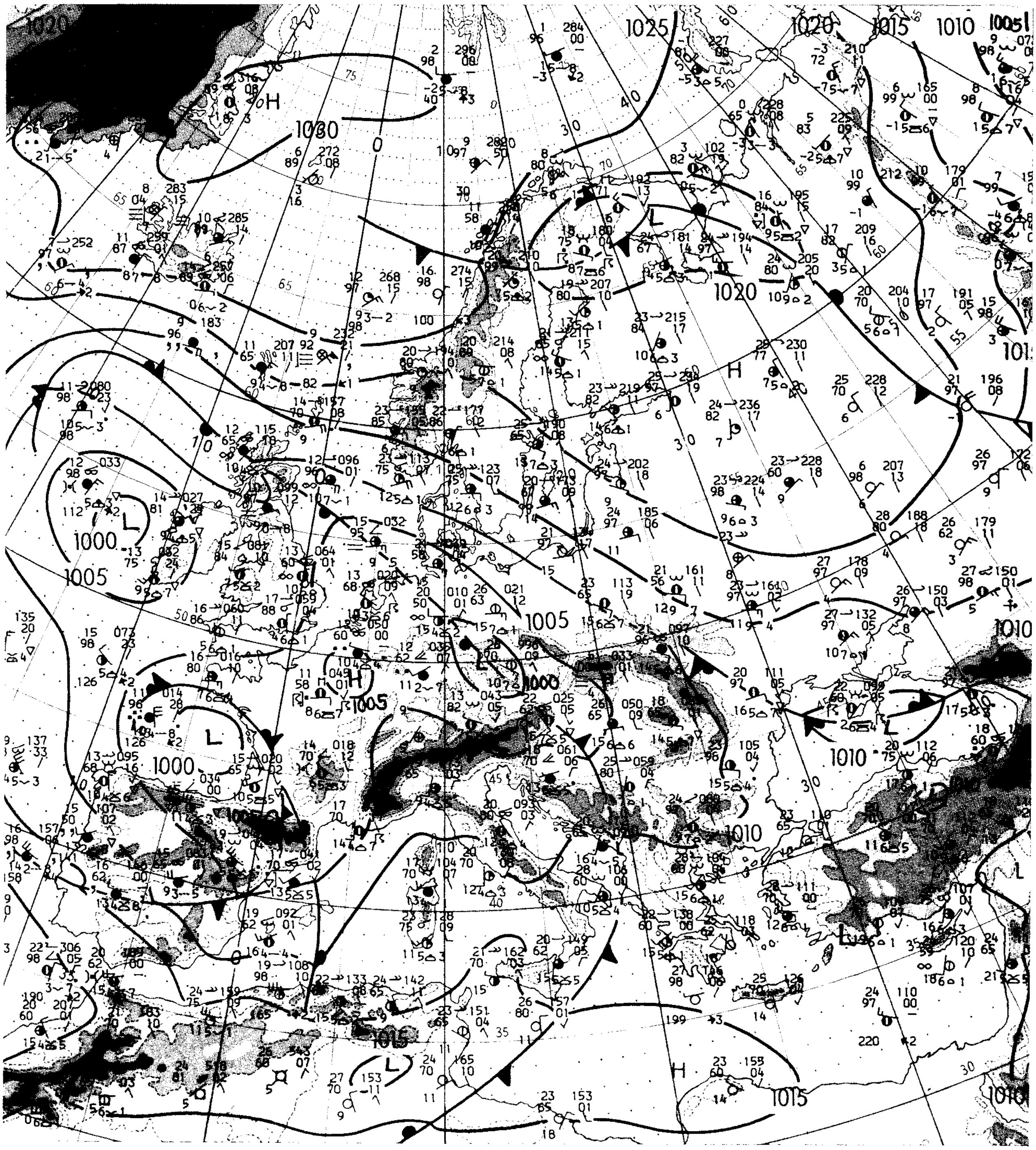


Figure 63. Surface chart at 1300 CET on June 4, 1984.

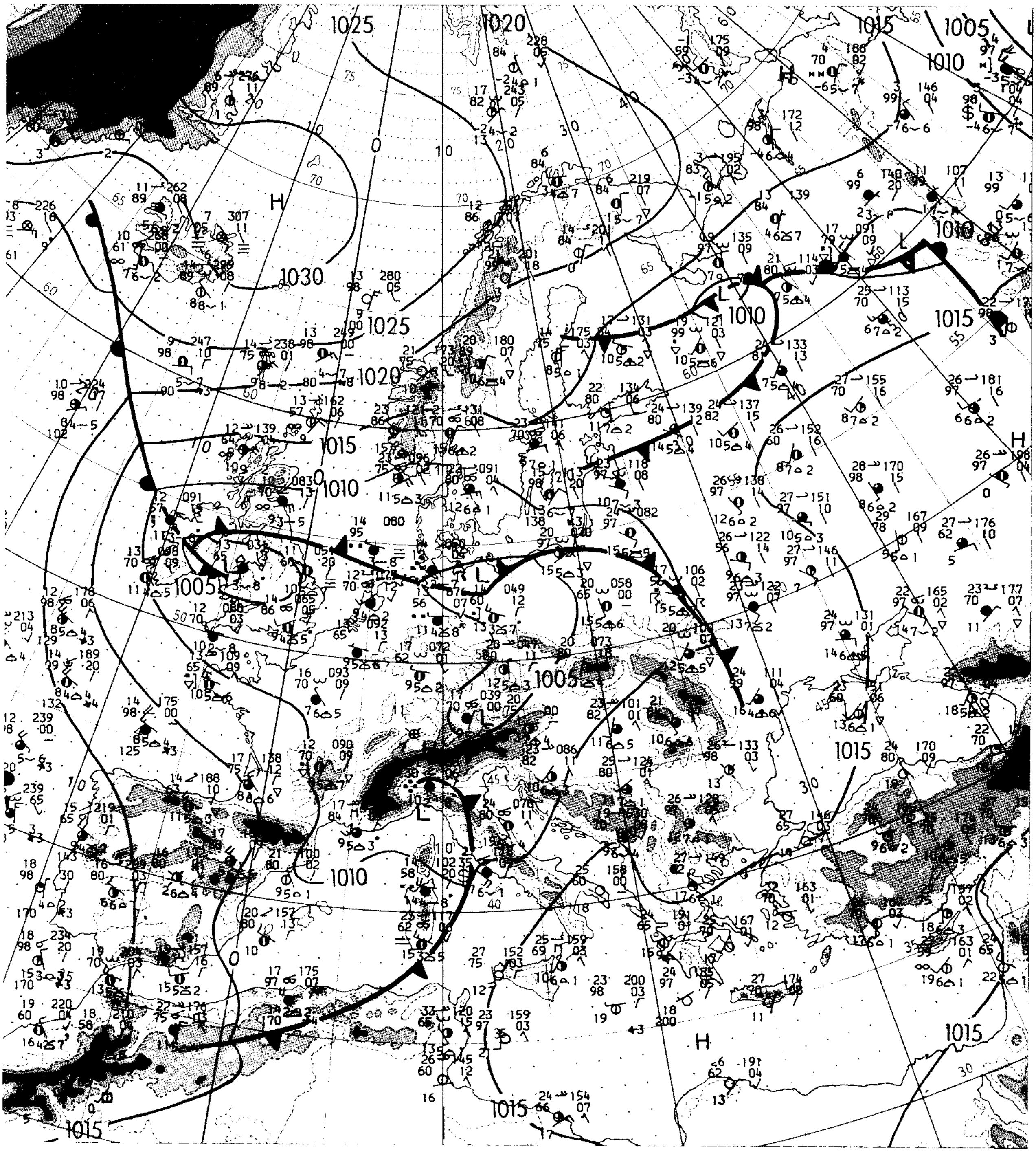


Figure 64. Surface chart at 1300 CET on June 5, 1984.

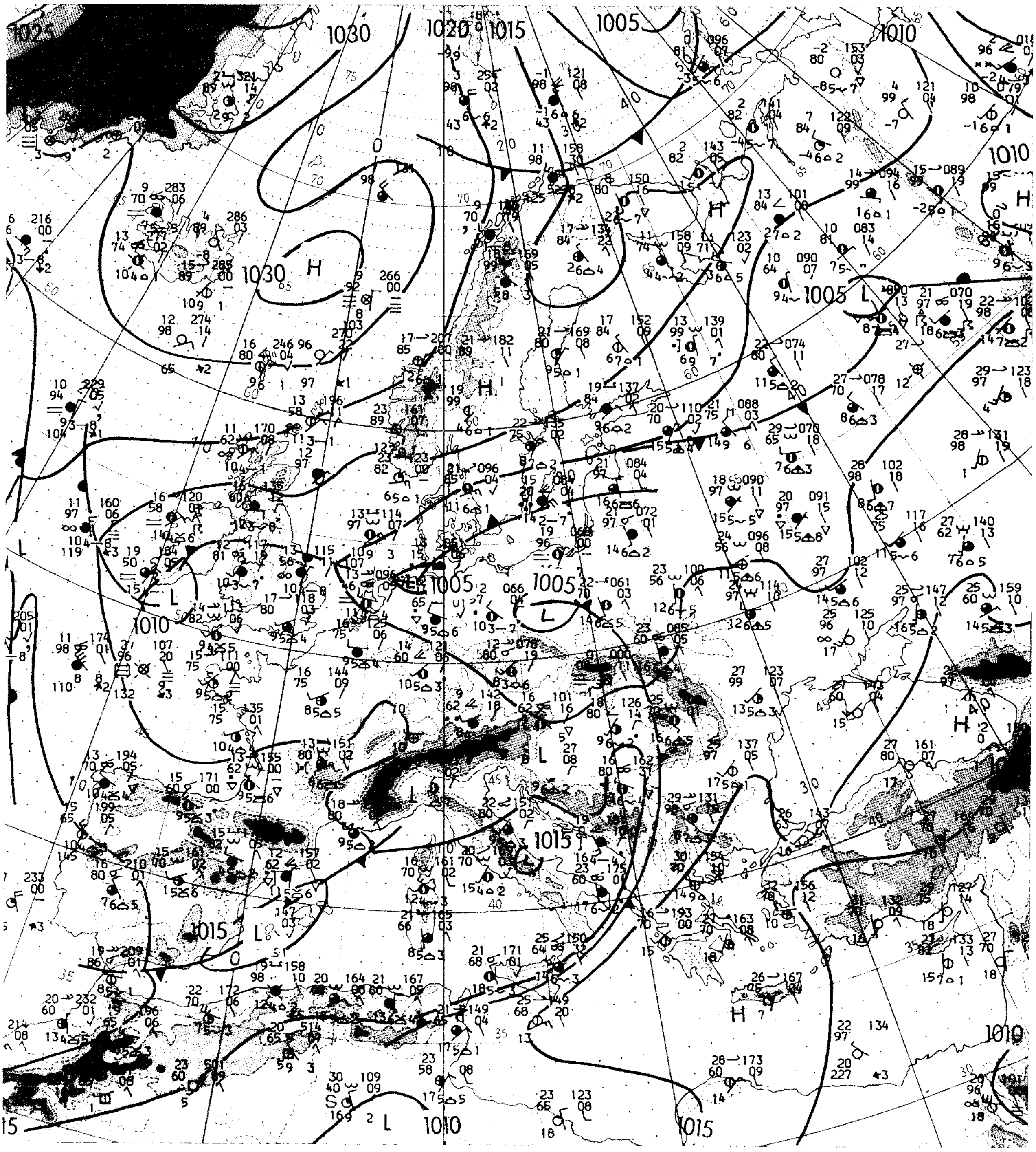


Figure 65. Surface chart at 1300 CET on June 6, 1984.

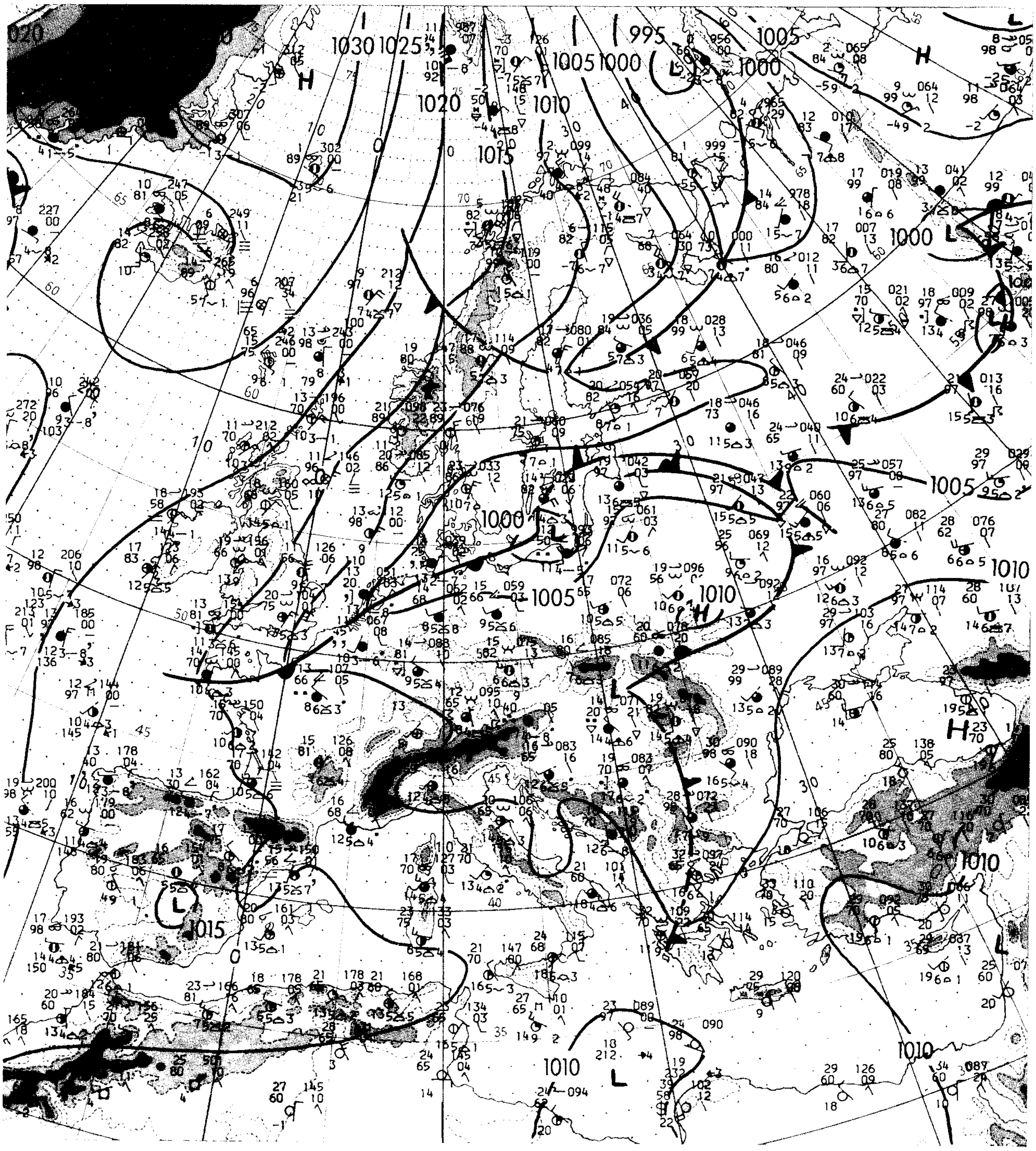


Figure 66. Surface chart at 1300 CET on June 7, 1984.

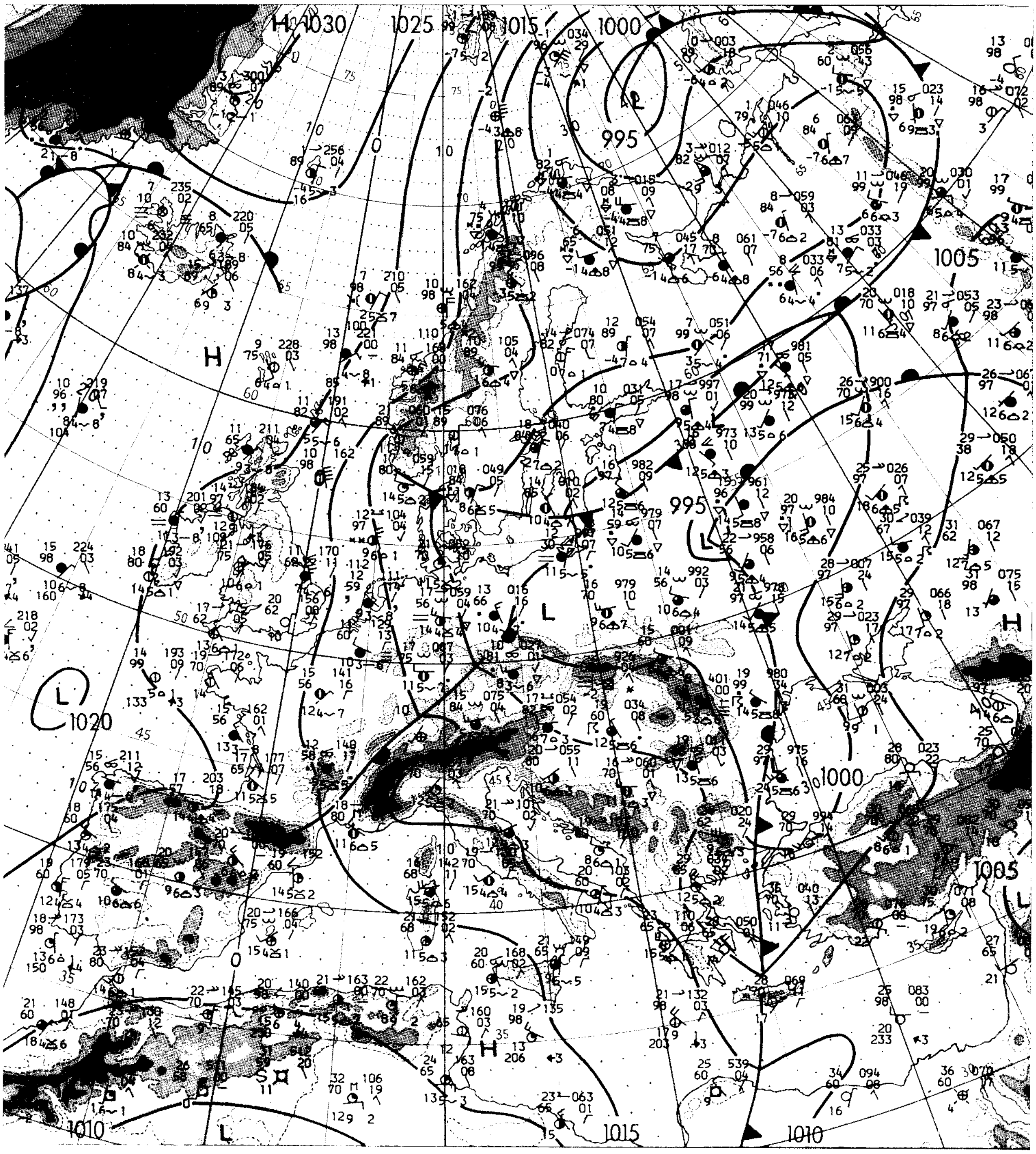


Figure 67. Surface chart at 1300 CET on June 8, 1984.

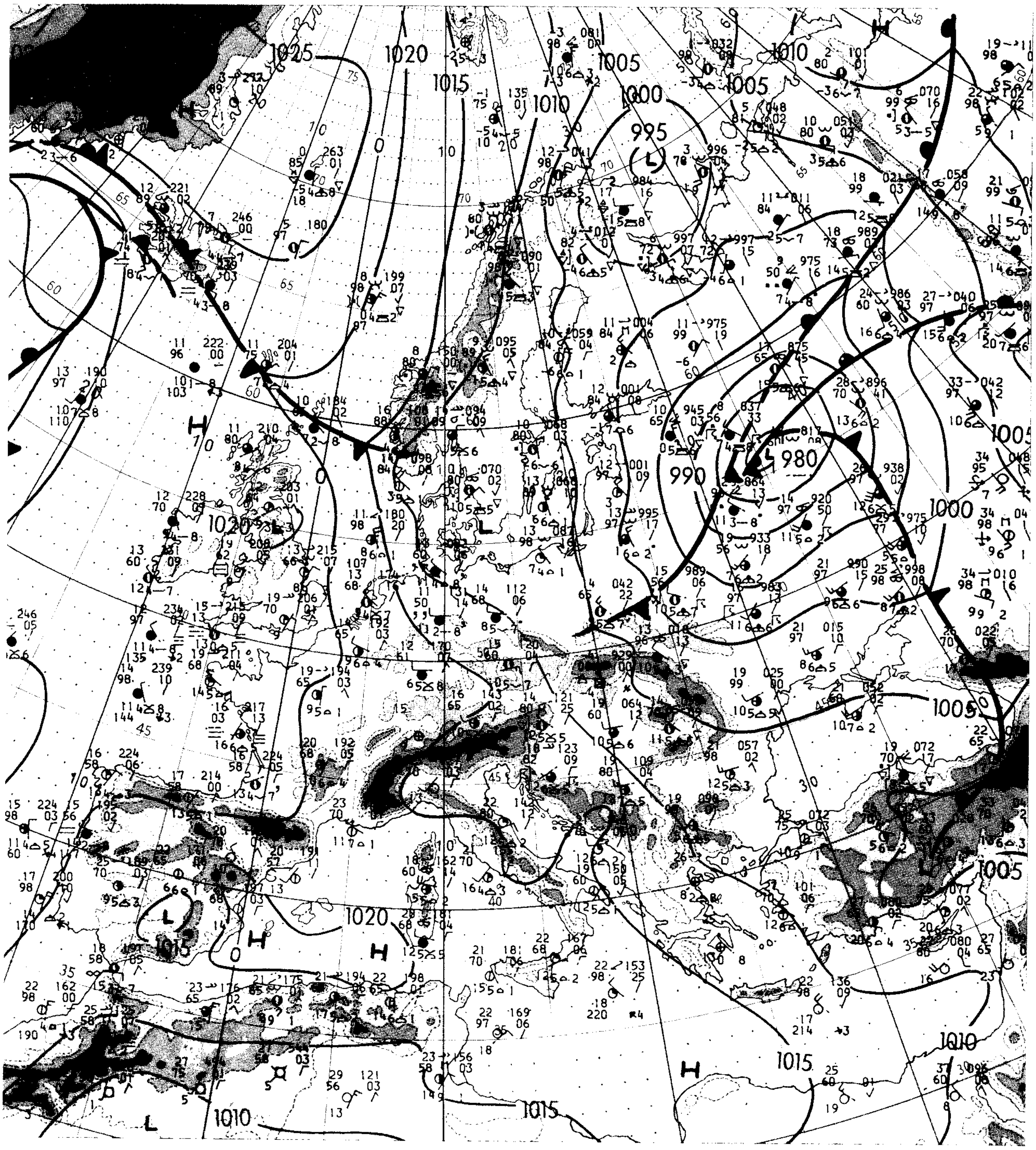


Figure 68. Surface chart at 1300 CET on June 9, 1984.

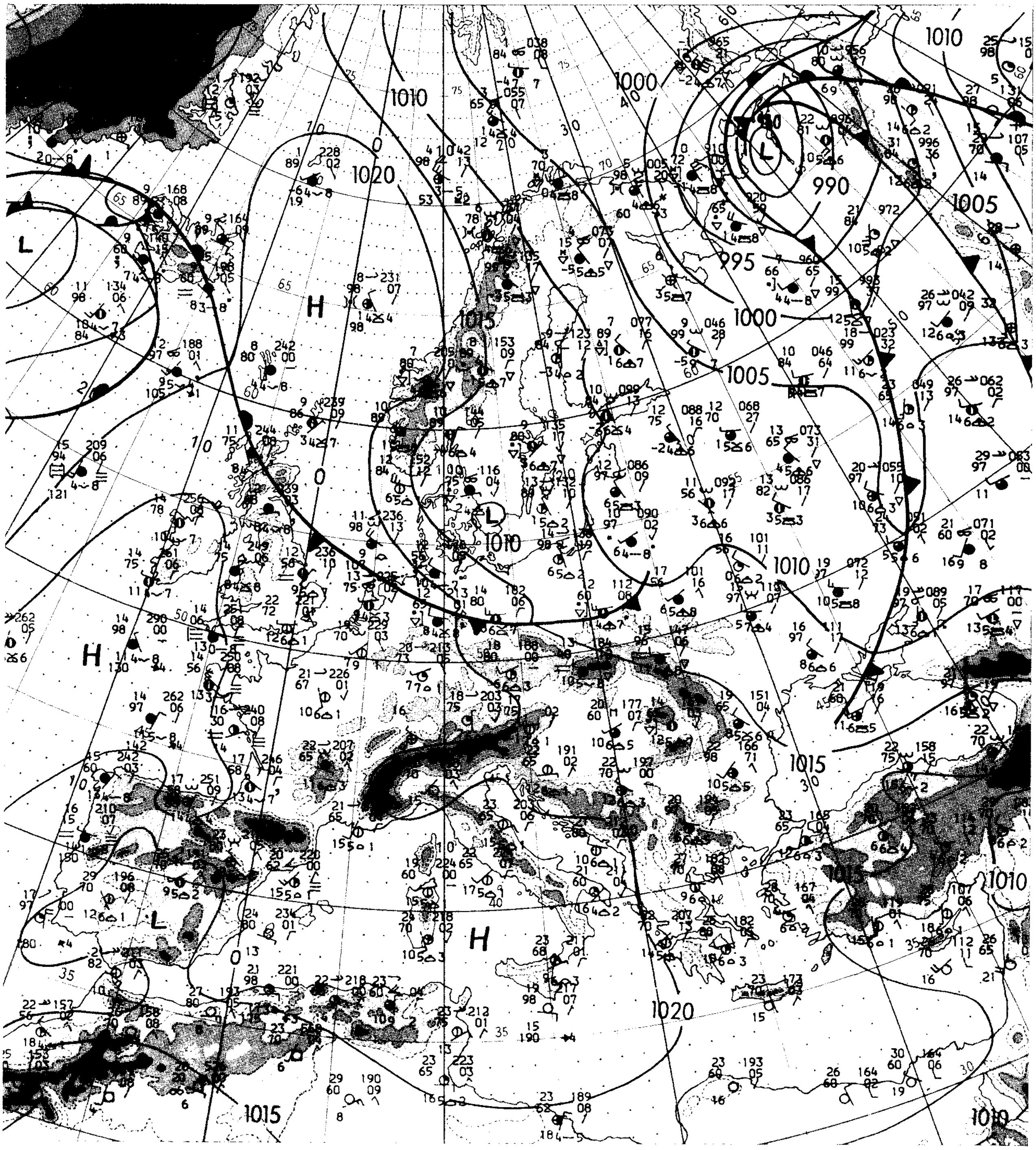


Figure 69. Surface chart at 1300 CET on June 10, 1984.

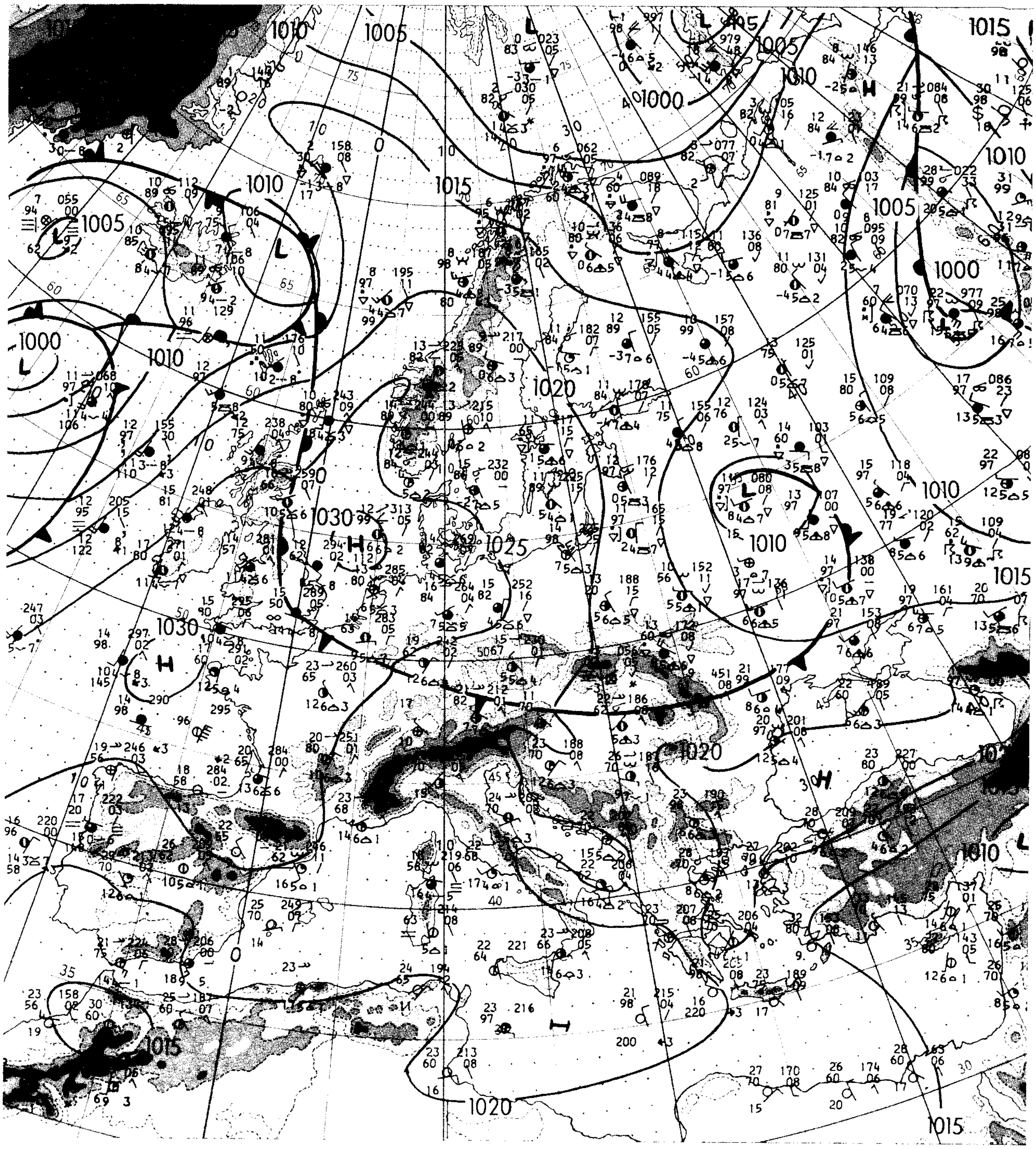


Figure 70. Surface chart at 1300 CET on June 11, 1984.

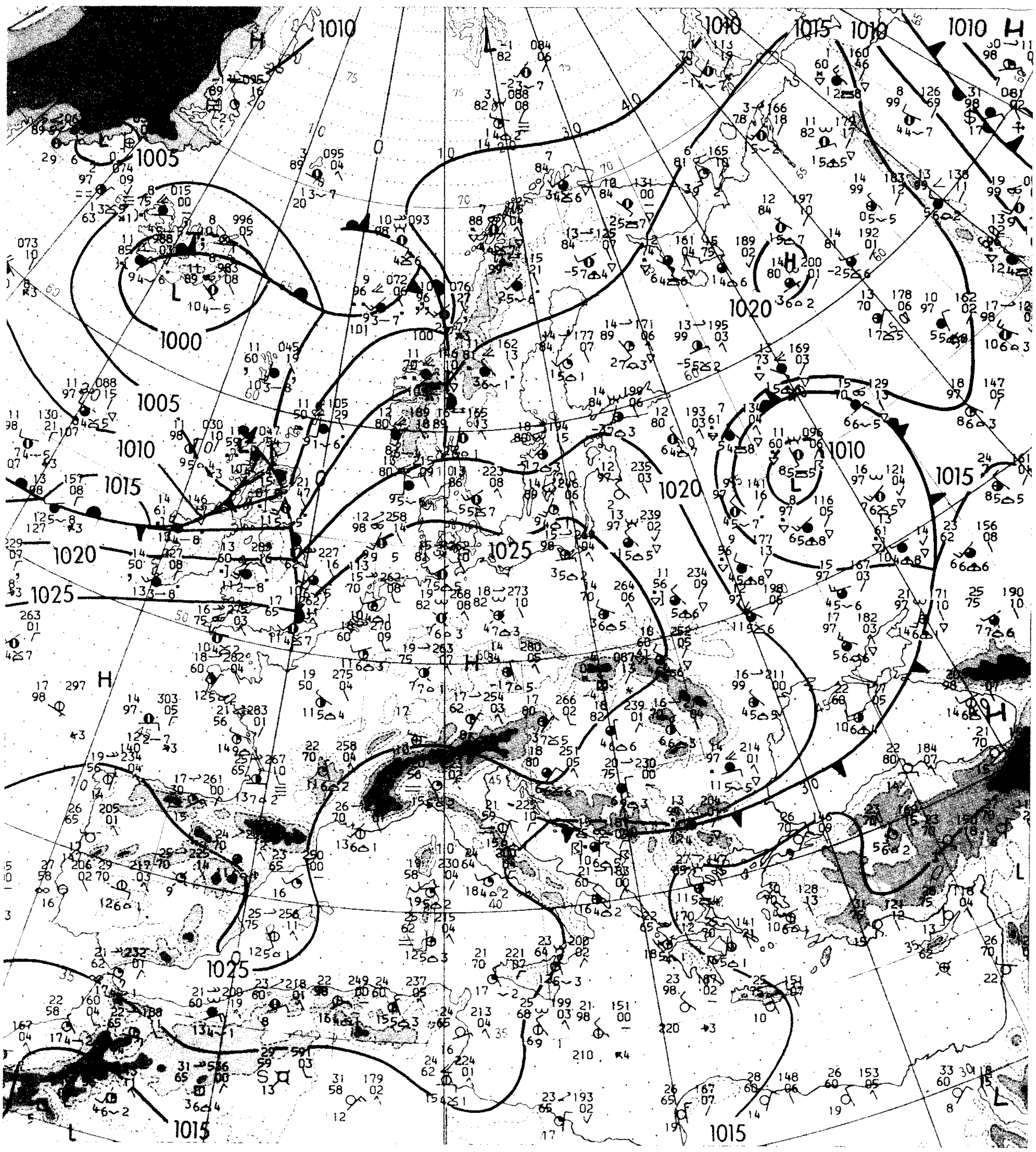


Figure 71. Surface chart at 1300 CET on June 12, 1984.

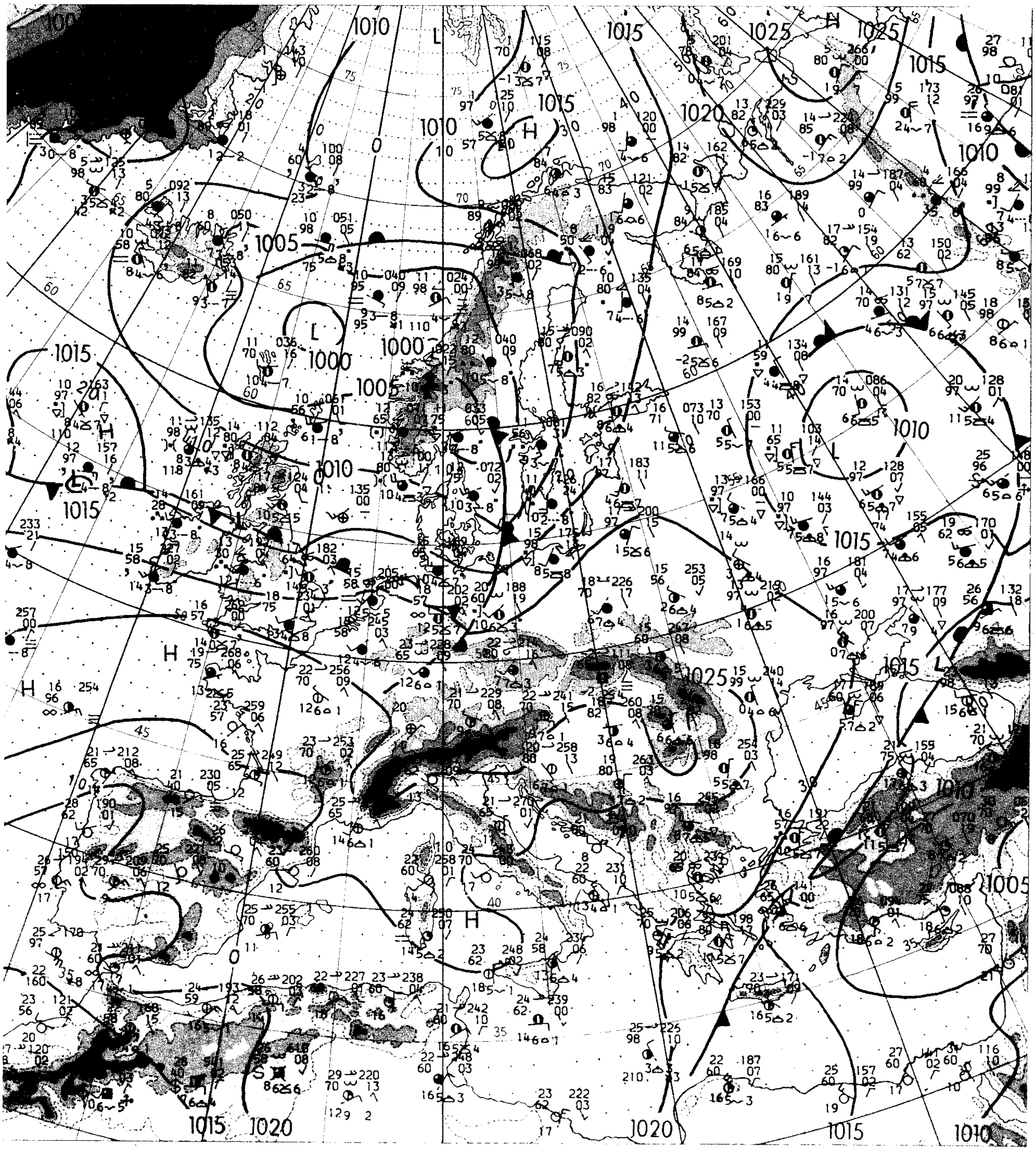


Figure 72. Surface chart at 1300 CET on June 13, 1984.

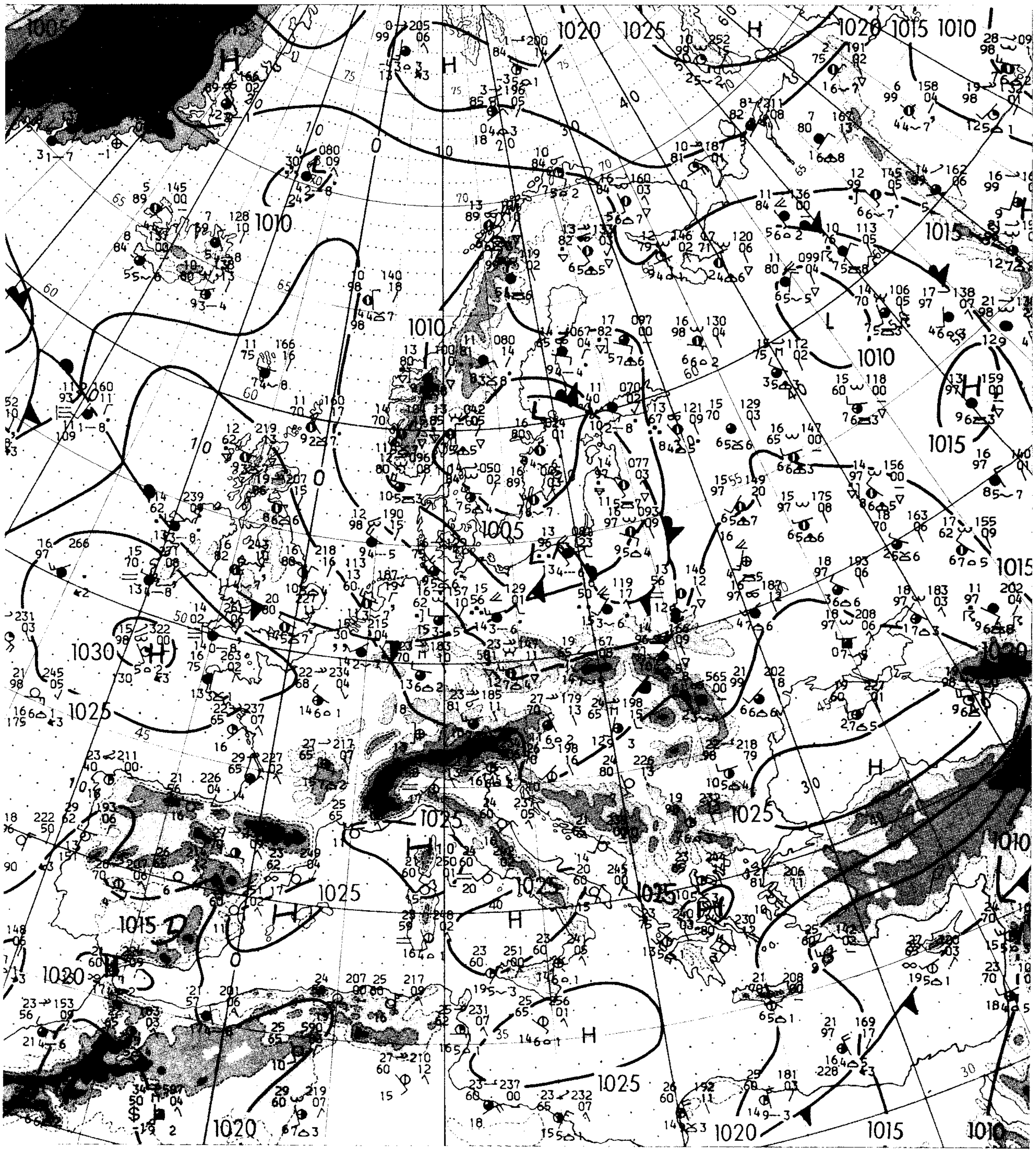


Figure 73. Surface chart at 1300 CET on June 14, 1984.

6 Satellite images

Satellite images from days of tracer experiments were recorded by the Observatory for Space Research of the Danish Meteorological Institute. The images were obtained from channel 2 of the NOAA 7 AVHRR satellite and the scale is approximately 1:3 000 000.

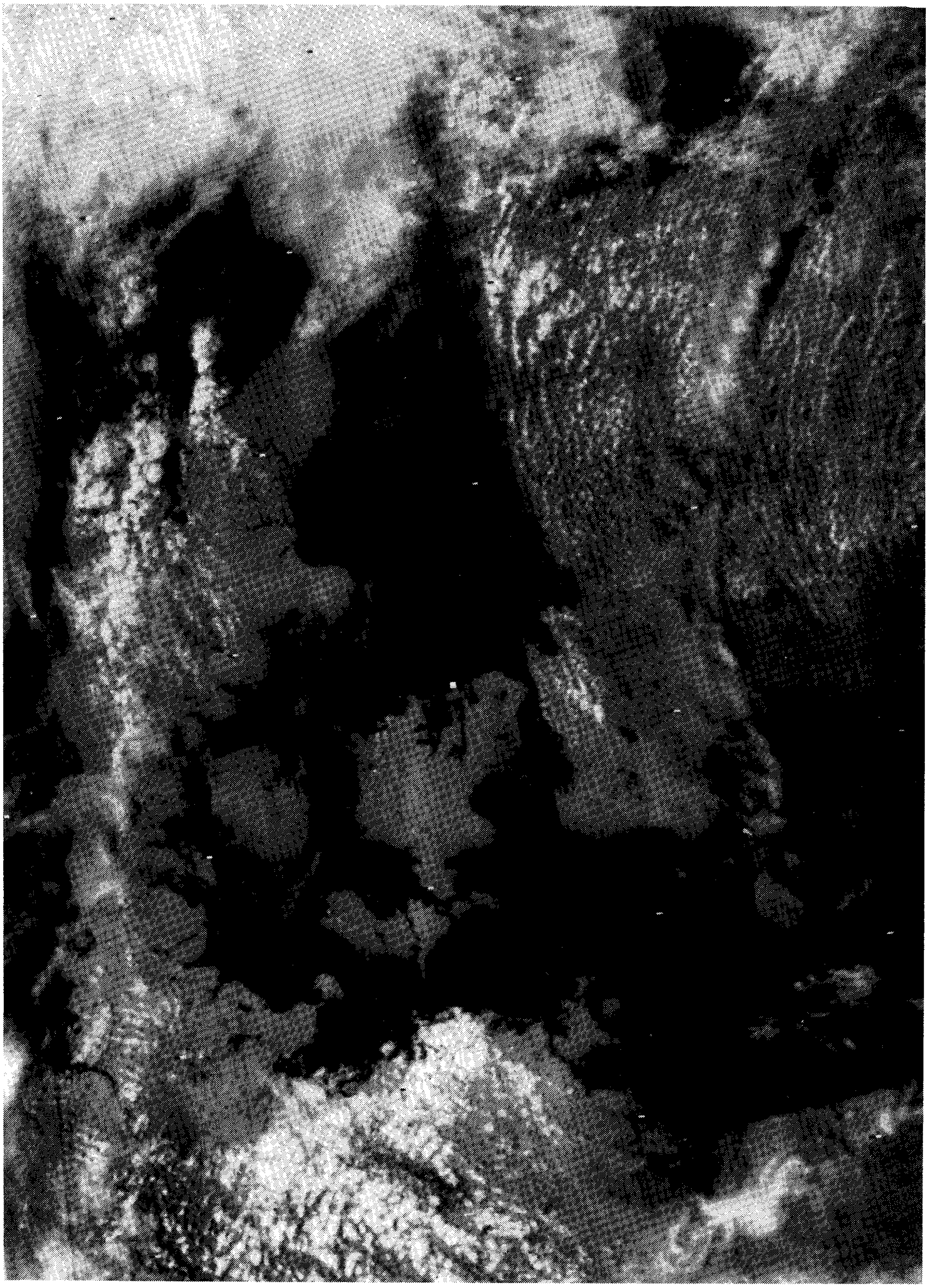


Figure 74. NOAA 7 satellite image at 14:09 CET on May 16, 1984.

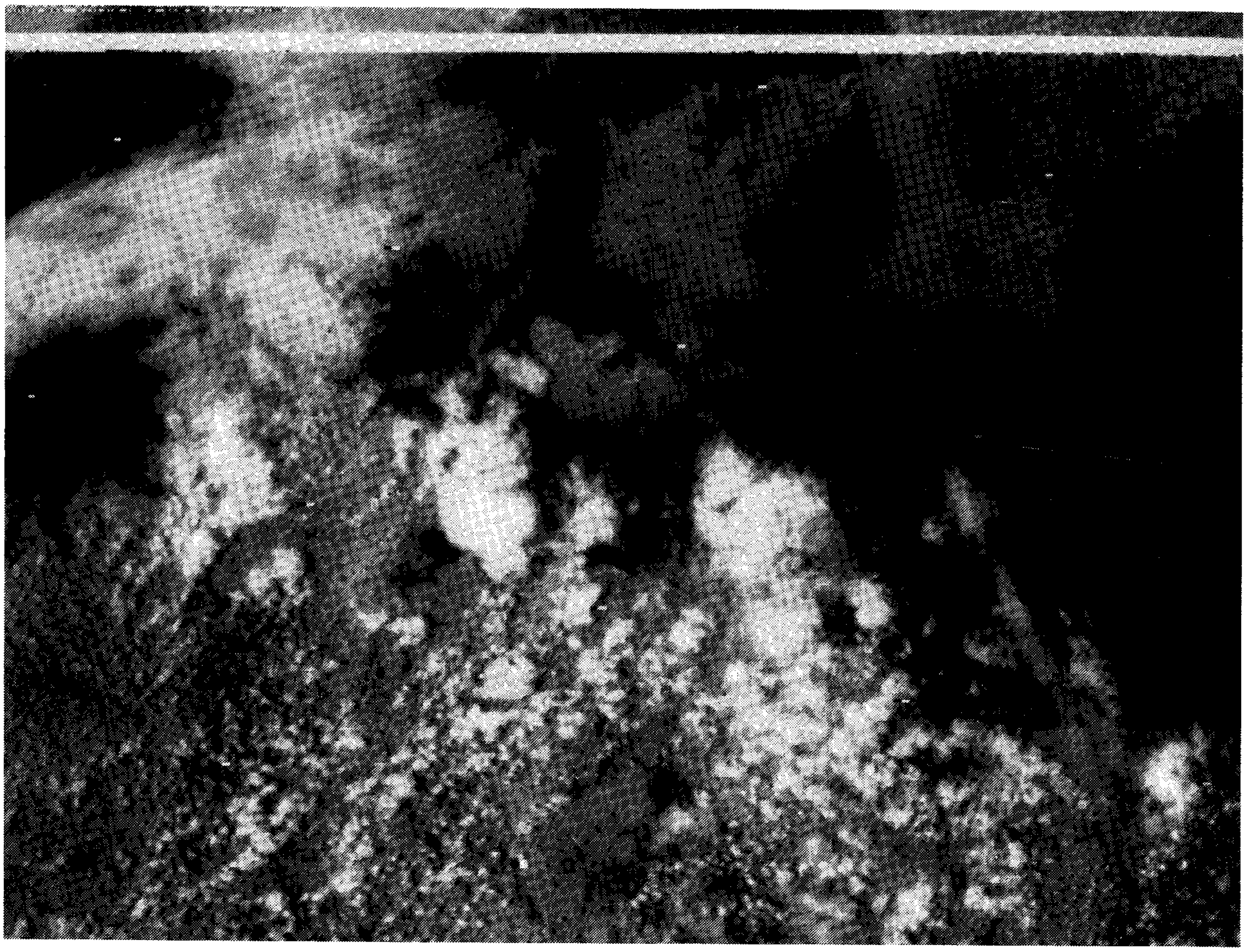


Figure 75. NOAA 7 satellite image at 13:45 CET on May 18, 1984.

Figure 76. NOAA 7 satellite image at 12:53 CET on May 22, 1984.

Figure 77. NOAA 7 satellite image at 13:11 CET on May 29, 1984.

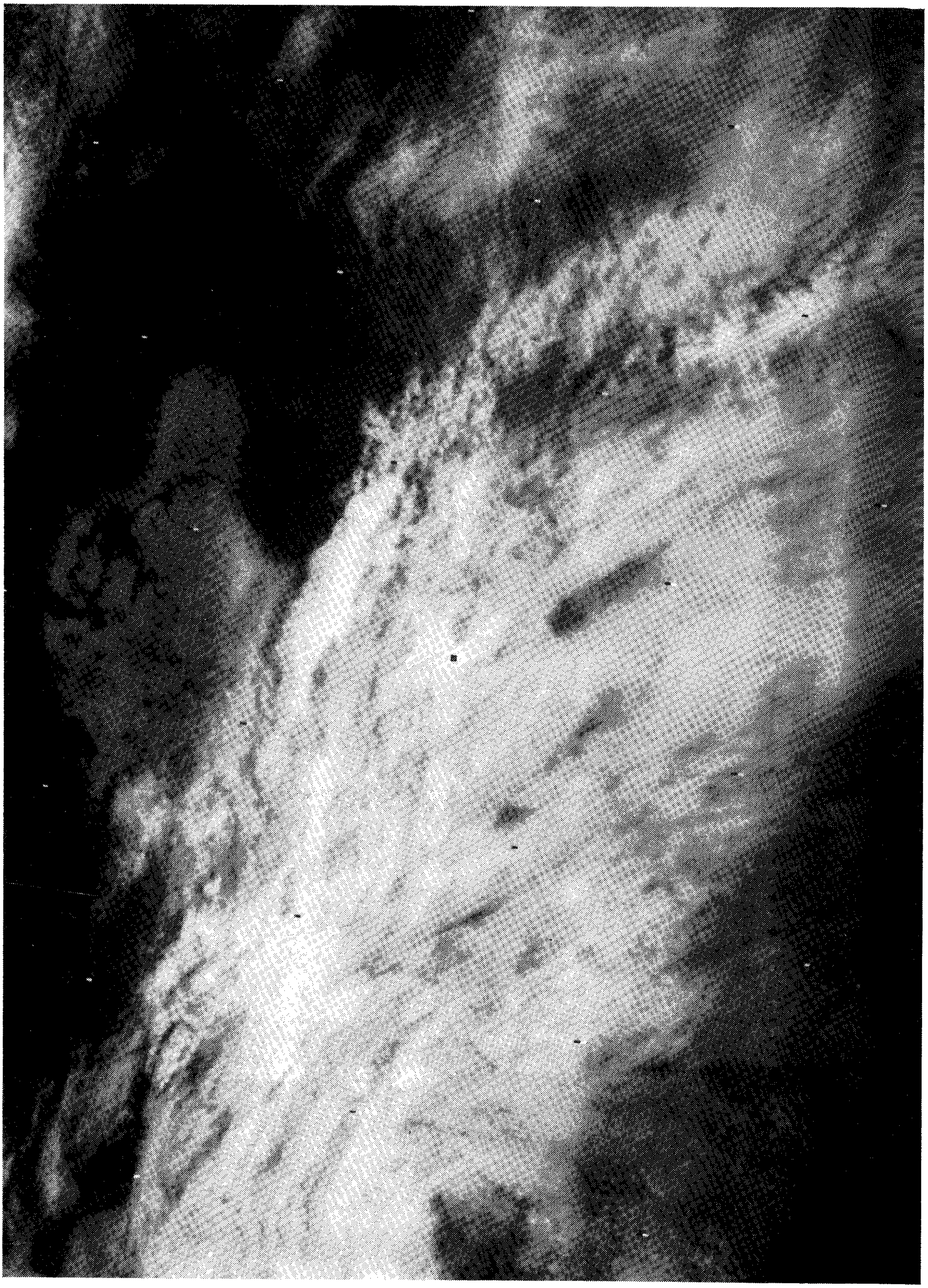


Figure 78. NOAA 7 satellite image at 08:15 CET on May 30, 1984.

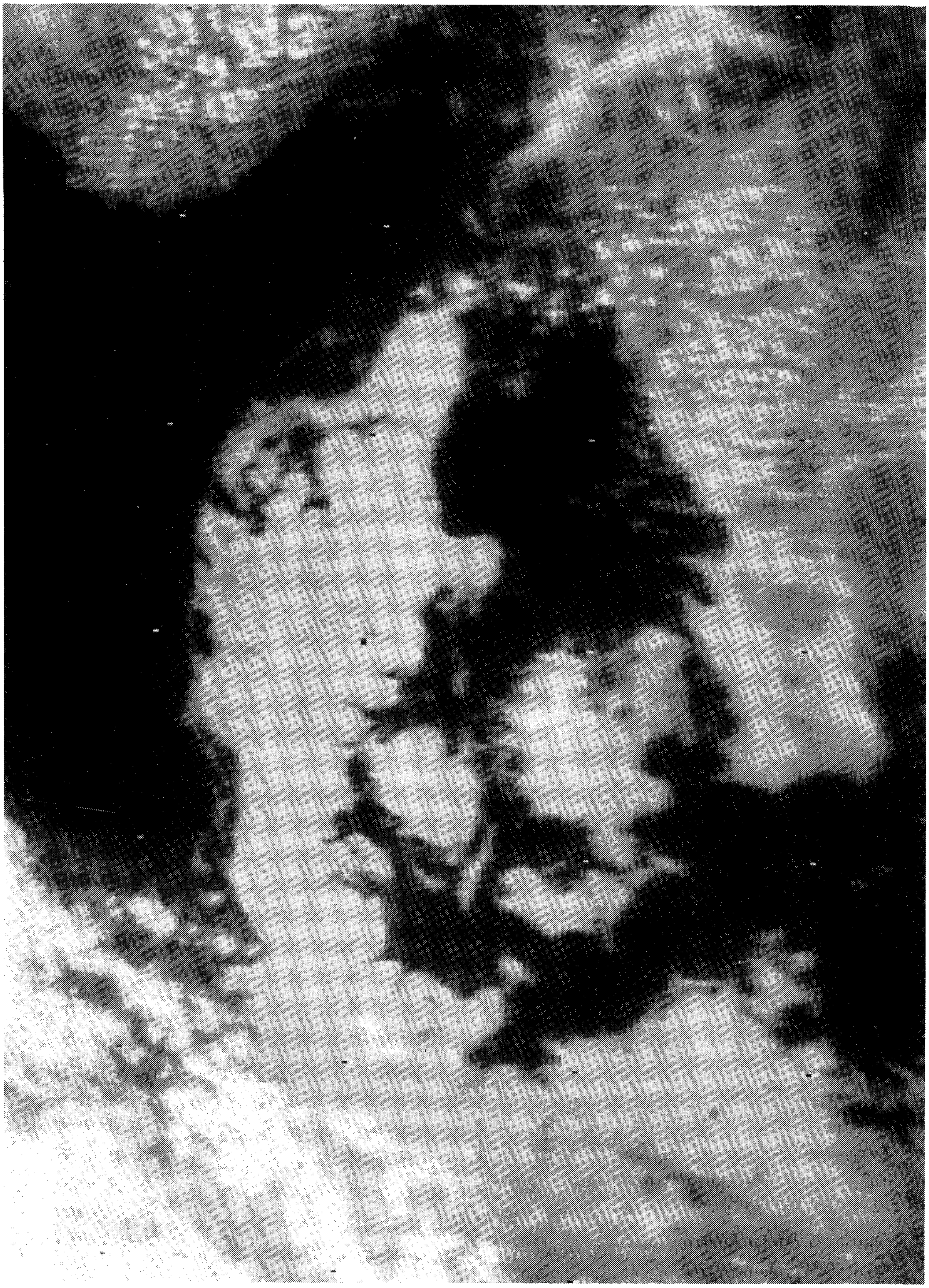


Figure 79. NOAA 7 satellite image at 15:17 CET on June 4, 1984.

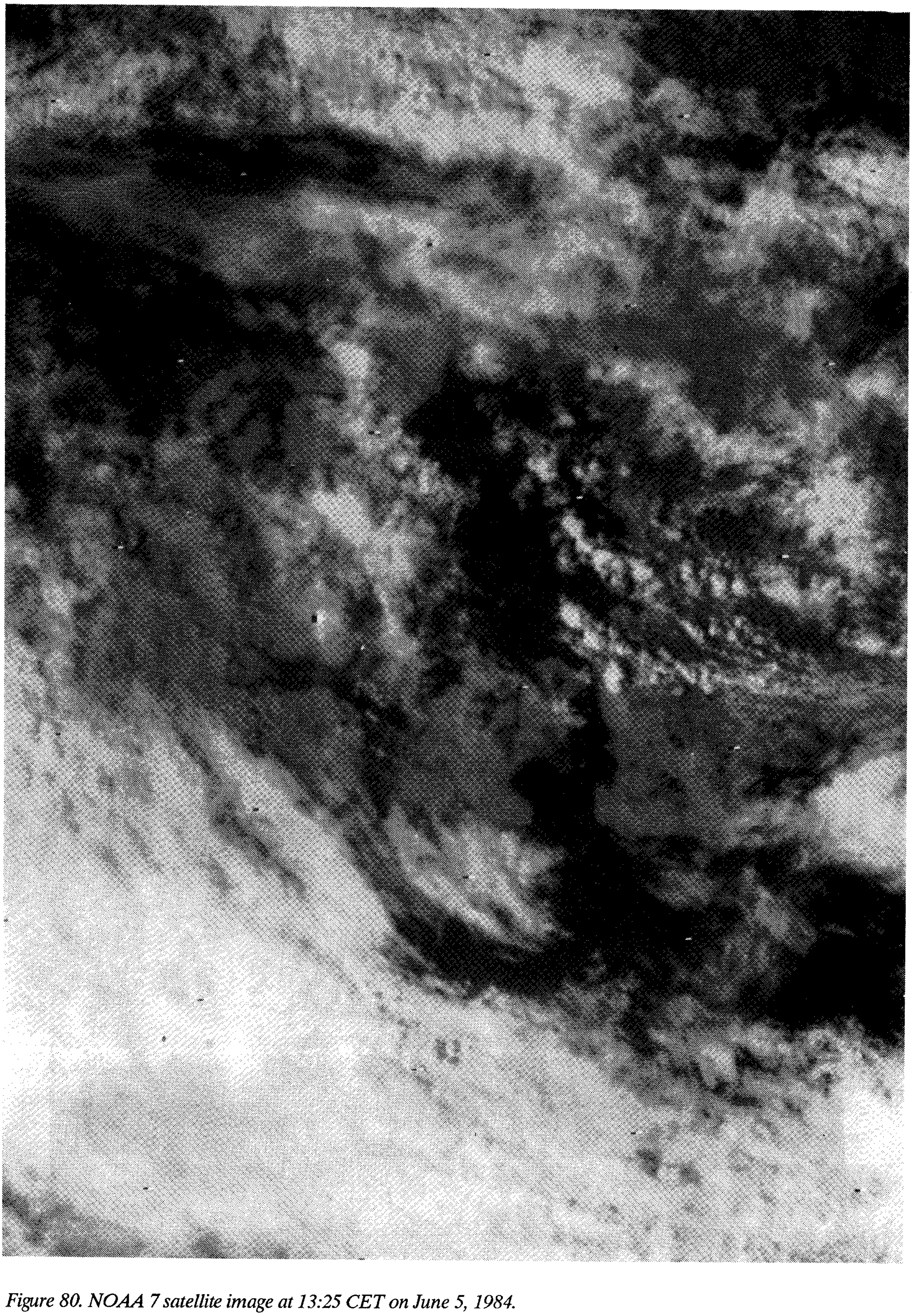


Figure 80. NOAA 7 satellite image at 13:25 CET on June 5, 1984.

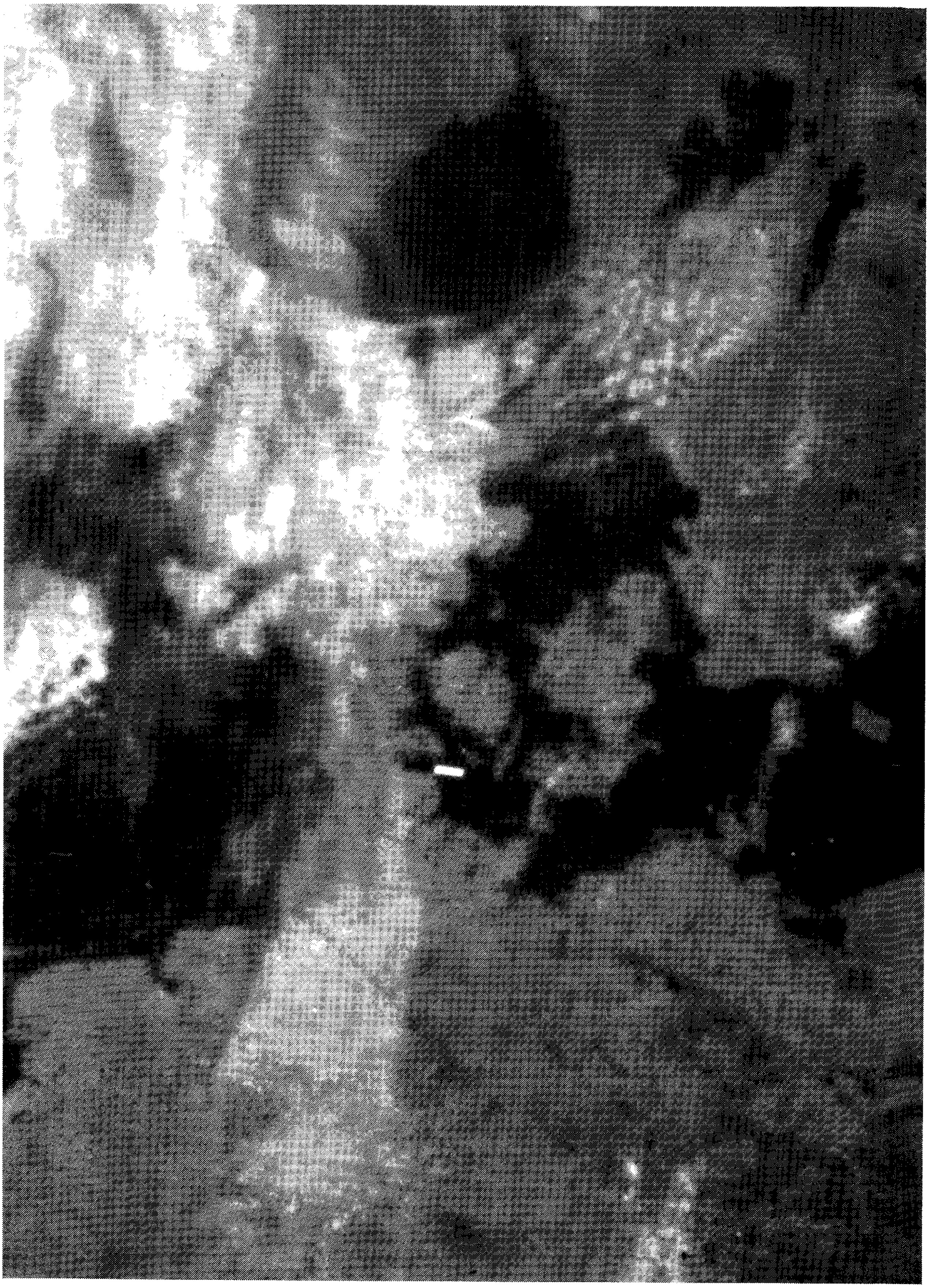


Figure 81. NOAA 7 satellite image at 06:54 CET on June 12, 1984.

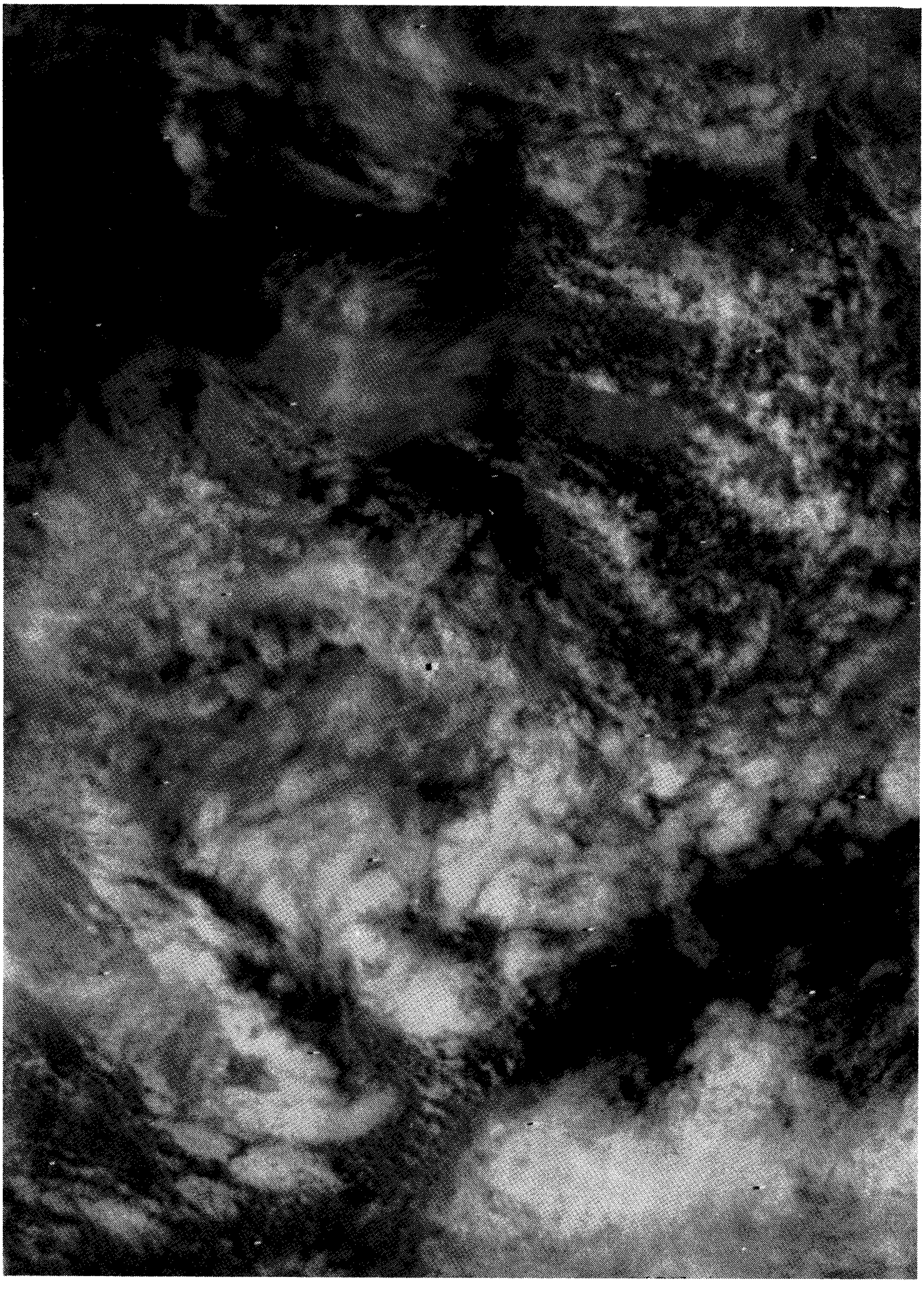


Figure 82. NOAA 7 satellite image at 13:14 CET on June 14, 1984.

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A GF-3 parameter code table

The GF-3 parameter codes (IOC, 1987) used in the Øresund Data Bank are listed below together with a short definition of the parameters and their units. A more detailed description of the parameters, the measurement principle and the instrument used is given in the *Plain Language Records* of each data file in the data bank.

The parameter codes used in GF-3 to identify each parameter are eight character fields `PPPPKMMS` divided into 4 subgroups: A parameter identifier (`PPPP`), a key for user defined options (`K`), a method identifier (`MM`), and a sphere parameter (`S`), see Fig. 87.

The key `K` for user defined options may take two values in the Øresund data bank: '7' means that the parameter code is a GF-3 standard – at the time of establishing the data bank – and '2' means that the code was defined by Risø specifically for this data tape. Notice also, that the method identifier/parameter qualifier (characters 6 and 7 of the parameter code) can only take two values in the Øresund Data Bank: `XX` (unspecified) means the the parameter was measured directly, whereas `CC` means that the parameter was calculated/derived from measurements.

General purpose parameters

`FFFF 6 XX N`	Quality control flag defined by user – consult plain language records for details

Date and time within day

`DATE 7 -- N`	Date within year in format `MMDD`
`TIME 7 -- N`	Time within day in format `HHMMSS`
`HHMM 7 -- N`	Time within day in format `HHMM`
`LT`	Time of observation, local time
`LE`	Time of observation end, local time
`XX`	Unspecified
`ZONE 7 XX N`	Time zone correction. Number of hours to be added to convert the stored date/time parameters to UTC (Coordinated Universal Time – equals GMT)

Time and frequency

`ETMN 7 XX N`	Elapsed time (minutes)
`ETSC 7 XX N`	Elapsed time (seconds)
`DRMN 7 -- N`	Duration (minutes)
`PR`	Interval of processed observations
`SS`	Original sampling/digitization interval

Position and navigation

`UTMZ 2 XX N`	Universal Transverse Mercator (UTM) Zone number

UTMN	2	XX	N	Universal Transverse Mercator (UTM) Northing in metres [m]
UTME	2	XX	N	Universal Transverse Mercator (UTM) Easting in metres [m]
DISE	2	XX	X	Distance East (true) in metres [m]
DISN	2	XX	X	Distance North (true) in metres [m]
DIST	2	XX	X	Distance in metres [m]
ALTG	2	XX	N	Altitude above ground level in metres [m]
ALTS	2	XX	N	Altitude above mean sea level in metres [m]

Physical oceanography

TEMP	7	--	D	Sea temperature in degrees celcius [°C]
		ST		STD/CTD sensor
		XX		Unspecified
SSTP	7	--	D	Sea surface temperature in degrees celcius [°C]
		RS		Infra-red scanner
		XX		Unspecified

Meteorology

Cloud, weather, visibility and precipitation

CCVR	2	XX	A	Cloud cover in tenths of sky [tenths]
CLDA	2	XX	A	Cloud amount [oktas]
CLDB	2	XX	A	Cloud base altitude in metres [m]
CLDG	2	XX	A	Cloud genus [METAR code]
VISB	2	XX	A	Horizontal visibility in metres [m]
WTHR	2	XX	A	Present weather [METAR code]
PRTN	2	XX	A	Precipitation in millimetres [mm]

Pressure and humidity

VAPP	2	XX	A	Actual water vapour pressure in hektopascal [hPa]
RELH	7	XX	A	Relative humidity in per cent [%]
SPEH	2	XX	A	Specific humidity in grammes/kilo [$\mathrm{g\,kg^{-1}}$]
PRTN	2	XX	A	Precipitation in millimetres [mm]
ATMP	2	XX	A	Atmospheric pressure at measurement level [hPa]
ATMS	7	XX	A	Atmospheric pressure reduced to mean sea level [hPa]

Wind

WSPD	7	XX	A	Wind speed (horizontal) in metres/second [$\mathrm{m\,s^{-1}}$]
WLON	2	XX	A	Longitudinal wind speed in metres/second [$\mathrm{m\,s^{-1}}$] positive towards east (unless otherwise stated)

WLAT 2 XX A	Lateral wind speed in metres/second [$m\,s^{-1}$] positive towards true north (unless otherwise stated)
WVER 2 XX A	Vertical wind speed in metres/second [$m\,s^{-1}$] positive upwards (unless otherwise stated)
WDIR 7 XX A	Wind direction in degrees [°] from true north
GSPD 7 XX A	Gust wind speed in metres/second [$m\,s^{-1}$]
GDIR 7 XX A	Gust wind direction in degrees [°] from true north
SDWS 2 XX A	Standard deviation of (horizontal) wind speed in [$m\,s^{-1}$]
SDLO 2 XX A	Standard deviation of longitudinal wind speed in [$m\,s^{-1}$]
SDLA 2 XX A	Standard deviation of lateral wind speed in [$m\,s^{-1}$]
SDVE 2 XX A	Standard deviation of vertical wind speed in [$m\,s^{-1}$]
SDWD 2 XX A	Standard deviation of wind direction in degrees [°]

Temperature

DRYT 7 XX A	Temperature (dry bulb) in degrees celcius [°C]
TDIF 2 XX A	Temperature difference between two levels [°C]
WETT 7 XX A	Wet bulb temperature in degrees celcius [°C]
TWDF 2 XX A	Wet bulb temperature difference between two levels
DEWT 2 XX A	Dew point temperature in degrees celcius [°C]
POTT 2 XX A	Potential temperature in degrees Kelvin [K]
VIRT 2 XX A	Virtual potential temperature in degrees Kelvin [K]
SOLT 2 XX G	Ground temperature in degrees celcius [°C]
BRIT 2 XX A	Brightness temperature in degrees Kelvin [K]

Radiation

SDIR 2 XX A	Short-wave direct radiation in [Wm^{-2}]
SINC 2 XX A	Short-wave incoming radiation in [Wm^{-2}]
SDIF 2 XX A	Short-wave diffuse radiation in [Wm^{-2}]
SOUT 2 XX A	Short-wave outgoing radiation in [Wm^{-2}]
LINC 2 XX A	Long-wave incoming radiation in [Wm^{-2}]
LOUT 2 XX A	Long-wave outgoing radiation in [Wm^{-2}]
ULTR 2 XX A	Ultra-violet radiation in Watts/square-metre [Wm^{-2}]
NIRR 2 XX A	Near-infrared radiation in Watts/square-metre [Wm^{-2}]
NETR 2 XX A	Net radiation in Watts/square-metre [Wm^{-2}]
QSOL 2 XX G	Ground heat flux in Watts/square-metre [Wm^{-2}]

Fluctuations in wind speed, temperature and humidity
The parameter codes for the turbulence statistics of wind speed (u, v, w), temperature (T) and humidity (E) are not used in the standard version of the Øresund Experiment Data Bank.

EE 2 CC A	Variance of E: $\overline{E'^2}$ [hPa^2]
TE 2 CC A	Covariance of T and E: $\overline{T'E'}$ [$K \cdot hPa$]
TT 2 CC A	Variance of T: $\overline{T'^2}$ [K^2]
UE 2 CC A	Covariance of u and E: $\overline{u'E'}$ [$m\,s^{-1} \cdot hPa$]
UT 2 CC A	Covariance of u and T: $\overline{u'T'}$ [$K \cdot m\,s^{-1}$]
UU 2 CC A	Variance of u: $\overline{u'^2}$ [$(m\,s^{-1})^2$]
UV 2 CC A	Covariance of u and v: $\overline{u'v'}$ [$(m\,s^{-1})^2$]
UW 2 CC A	Covariance of u and w: $\overline{u'w'}$ [$(m\,s^{-1})^2$]
VE 2 CC A	Covariance of v and E: $\overline{v'E'}$ [$hPa \cdot m\,s^{-1}$]
VT 2 CC A	Covariance of v and T: $\overline{v'T'}$ [$K \cdot m\,s^{-1}$]
VV 2 CC A	Variance of v: $\overline{v'^2}$ [$(m\,s^{-1})^2$]
VW 2 CC A	Covariance of v and w: $\overline{v'w'}$ [$(m\,s^{-1})^2$]
WE 2 CC A	Covariance of w and E: $\overline{w'E'}$ [$hPa \cdot m\,s^{-1}$]
WT 2 CC A	Covariance of w and T: $\overline{w'T'}$ [$K \cdot m\,s^{-1}$]
WW 2 CC A	Variance of w: $\overline{w'^2}$ [$(m\,s^{-1})^2$]
EEE 2 CC A	Third moment of E: $\overline{E'^3}$ [hPa^3]
TTT 2 CC A	Third moment of T: $\overline{T'^3}$ [K^3]
UUU 2 CC A	Third moment of u: $\overline{u'^3}$ [$(m\,s^{-1})^3$]
UUW 2 CC A	$\overline{u'^2w'}$ [$(m\,s^{-1})^3$]
UVW 2 CC A	$\overline{u'v'w'}$ [$(m\,s^{-1})^3$]
UWW 2 CC A	$\overline{u'w'^2}$ [$(m\,s^{-1})^3$]
VVV 2 CC A	Third moment of v: $\overline{v'^3}$ [$(m\,s^{-1})^3$]
VVW 2 CC A	$\overline{v'^2w'}$ [$(m\,s^{-1})^3$]
WEE 2 CC A	$\overline{w'E'^2}$ [$hPa^2 \cdot m\,s^{-1}$]
WTT 2 CC A	$\overline{w'T'^2}$ [$K^2 \cdot m\,s^{-1}$]
WWE 2 CC A	$\overline{w'^2E'}$ [$hPa^2 \cdot m\,s^{-1}$]
WWT 2 CC A	$\overline{w'^2T'}$ [$K^2 \cdot m\,s^{-1}$]
WWW 2 CC A	Third moment of w: $\overline{w'^3}$ [$(m\,s^{-1})^3$]
EEEE 2 CC A	Fourth moment of E: $\overline{E'^4}$ [hPa^4]
TTTT 2 CC A	Fourth moment of T: $\overline{T'^4}$ [K^4]
UUUU 2 CC A	Fourth moment of u: $\overline{u'^4}$ [$(m\,s^{-1})^4$]
VVVV 2 CC A	Fourth moment of v: $\overline{v'^4}$ [$(m\,s^{-1})^4$]
WWWW 2 CC A	Fourth moment of w: $\overline{w'^4}$ [$(m\,s^{-1})^4$]

Miscellaneous

`IDNO 2 XX N`	Identification number – consult plain language records for details
`PAIR 2 XX N`	Counter of coordinate pairs
`EXPN 2 CC N`	Decimal exponent of following parameter
`SCAN 2 XX N`	Scan number
`NSCN 2 XX N`	Number of scans
`ANGL 2 XX A`	Angle in degrees [°]
`SDEV 2 XX N`	Standard deviation of preceding parameter
`QVAL 2 XX A`	Sodar quality factor in per cent [%]
`ECHO 2 XX A`	Sodar echo magnitude in per mille (tenths of per cent)
`ISPD 2 XX N`	Indicated speed of platform (aircraft) in [$m\,s^{-1}$]
`FLOW 2 XX N`	Flow rate in litres/minute [$l\,min^{-1}$]
`TURB 2 XX A`	Longitudinal turbulence in R-units [0 – 10]
`BSCT 2 XX A`	B-scat values from nephelometer in 1/metres [m^{-1}]
`RATE 2 XX A`	Tracer release rate in grammes/second [$g\,s^{-1}$]
`CONC 2 XX A`	Tracer concentration in nano-grammes/cubic-metre [$10^{-9}\,g\,m^{-3}$]

B Sample data bank file

An example of a GF-3 file – typical of the the way GF-3 has been employed for the Øresund Experiment Data Bank – is given in Figs. 83–90, see also Figs. 1 and 2. Notice, that only the first 8 GF-3 records of the file are listed – the remaining records are all data cycle records corresponding closely to Fig. 90.

```
50 OERESUND269RNL          DENMARK   RISOE NAT. LAB.861126154014         022001
514MET-MASTS                    SJAELSMARK          198405150010198406150000002
5                                                                           003
5198406040010  198406060000  555268N 122527E100  -30099999999999999999999999999004
599999999999999999999999999999999999   NAME/0103KAL      1          0      0005
5                                                                           006
5                                                                           007
5                                                                           008
5                                                                           009
5                                                                           010
5                                                                           011
5                                                                           012
5                                                                           013
5                                                                           014
5                                                                           015
5                                                                           016
5                                                                           017
5                                                                           018
5                                                                           019
5                                                                           020
5                                                                           021
5                                                                           022
5                                                                           023
5                                                                           024
```

Figure 83. The mandatory File Header Record *defines the beginning of a data file and contains information that is common to the file as a whole, e.g. the name of the data collecting institution, the name of the station or platform, and the ranges in time and space within which the data were collected.*

```
00  SOURCE OF DATA: RISOE NATIONAL LABORATORY                              001
0                   POSTBOX 49, DK-4000 ROSKILDE, D E N M A R K            002
0                   PHONE: (02) 37 12 12         TELEX: 43116              003
0                                                                          004
0   CONTACT PERSON: SVEN-ERIK GRYNING (EXT. 4712)                          005
0   ------------------------------------------------------------------     006
0   STATION NAME: SJAELSMARK            TYPE: 10-M METEOROLOGY MAST        007
0   POSITION:  LATITUDE 55 52 41.0 N   LONGITUDE 12 25 16.2 E             008
0     ZONE 33  NORTHING  6195650.0 M   EASTING     338670.0 M             009
0   ELEVATION: 30.0 M A.S.L.                                               010
0   ------------------------------------------------------------------     011
0   DATA DESCRIPTION: TIME-SERIES OF  8 METEOROLOGICAL VARIABLES           012
0   START OF SERIES:  MAY 15, 1984 AT 00:10 C.E.T. (GMT + 1)               013
0   END OF SERIES:   JUNE 15, 1984 AT 00:00 C.E.T. (GMT + 1)               014
0   OBS. INTERVAL: 10 MINUTES           NO. OF SCANS: 4464                 015
0   ------------------------------------------------------------------     016
0   NAME OF ORIGINAL DATAFILE: RAWDATA/RISQ/SJAELSMARK                     017
0   NAME OF INTERMEDIATE FILE: MASTDATA/RISQ/SJAELSMARK                    018
0   ------------------------------------------------------------------     019
0   REFERENCE TO THE MEASUREMENTS IS:                                      020
0   GRYNING, S-E. AND MORTENSEN, N. G. (1986). THE OERESUND EXPERIMENT -   021
0       METEOROLOGICAL MEASUREMENTS (MASTS, TURBULENCE, MINI-SONDES)       022
0       PERFORMED BY RISOE NATIONAL LABORATORY. RISOE-R-467, 70 PP.        023
0                                                                          024
```

Figure 84. The next record of the data file is an optional Plain Language Record. *It contains almost the same information as the file header record; however, in a more readable form. Reference to the technical report describing the measurements is also given.*

```
00 T H E   P A R A M E T E R S:
0  WSPD MEASURED WITH 3-CUP ANEMOMETERS, DISTANCE CONSTANT = 1.5 M,
0       STARTING SPEED = 0.2 M/S, AVERAGING TIME = 10 MIN, ACCURACY =
0       +-1 PCT ( U > 5 M/S ) AND  +-0.05 M/S ( U < 5 M/S ).
0  WDIR MEASURED WITH WIND VANE, INSTANTANEOUS VALUE EVERY 10 MIN, TRESHOLD
0       SPEED  < 0.3 M/S, ACCURACY = +-5 DEG. ZERO IS TRUE NORTH.
0  DRYT MEASURED WITH PT-500 RESISTANCE THERMOMETERS, INSTANTANEOUS VALUE
0       EVERY 10 MIN, TIME CONSTANT < 0.5 MIN, SENSITIVITY = 0.09 DEG C.
0       MOUNTED IN NATURALLY VENTILATED THALLER-TYPE RADIATION SCREENS.
0  TDIF MEASURED WITH SAME TYPE OF SENSOR, SENSITIVITY < 0.05 DEG C.
0  RELH MEASURED WITH HAIR HYGROMETER, INSTANTANEOUS VALUE EVERY 10 MIN,
0       TIME CONSTANT UNKNOWN, ACCURACY = +-2.5 PCT.
0  ATMP MEASURED WITH ANEROID BAROMETER, INSTANTANEOUS VALUE EVERY 10 MIN,
0       ACCURACY = +-0.3 HPA. MEASUREMENTS NOT REDUCED TO MEAN SEA LEVEL.
0
0  T H E   D A T A:
0  THE DATA HAVE BEEN SCANNED FOR ERRONEOUS MEASUREMENTS BY VISUAL INSPEC-
0  TION OF THE PLOTTED TIME SERIES AND COMPARISON WITH THE TIME SERIES OF
0  THE OTHER METEOROLOGY MASTS IN THE OERESUND EXPERIMENT, AND ARE THOUGHT
0  TO BE OF GOOD QUALITY.
0
0  EXTENDED PERIODS OF MISSING DATA: NONE
0
0
```

Figure 85. The next Plain Language Record *provides information on the sensor type and its characteristic properties (sensitivity, time constant, accuracy etc.) for each of the measured parameters. The overall quality of the data is estimated in broad terms and extended periods of missing data are also reported.*

```
04 T H E   S I T E:
0  THE MAST IS SITUATED 8 KM WEST OF THE OERESUND COAST IN A MILITARY
0  TRAINING AREA. THE SURFACE CONSISTS MOSTLY OF LONG GRASS, BUT WITH SOME
0  BARE AREAS (WHEEL TRACKS ETC).
0
0  THE WIND SPEED AND HUMIDITY SENSORS ARE MOUNTED SOUTH OF THE MAST AND
0  THE WIND DIRECTION AND TEMPERATURE SENSORS NORTH OF THE MAST.
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
```

Figure 86. Finally, a short description is given of the measuring site and significant aspects of the experimental set-up that may further influence the measured data.

```
46  0  81         (60X,23(2I5,3I4,I5,I4,I8,2X,2I5,3I4,I5,I4,I8))                 001
4                                                                                 002
4                                                                                 003
4 WSPD7XXA  1WIND SPEED    3.0 M   (M/S)I   4 94  0.0100  0.0000                 004
4 WSPD7XXA  2WIND SPEED   10.0 M   (M/S)I   4 94  0.0100  0.0000                 005
4 WDIR7XXA   WIND DIRN.   10.0 M   (DEG)I   3 93  1.0000  0.0000                 006
4 DRYT7XXA  1TEMPERATURE   3.0 M (DEG C)I   3 93  0.1000  0.0000                 007
4 DRYT7XXA  2TEMPERATURE  10.0 M (DEG C)I   3 93  0.1000  0.0000                 008
4 TDIF2XXA   TEMP. DIFF.  10-3 M (DEG C)I   4 94  0.0100  0.0000                 009
4 RELH7XXA   RELATIVE HUMIDITY 2 M (PCT)I   3 93  1.0000  0.0000                 010
4 ATMP2XXA   ATM. PRESSURE 2.0 M   (HPA)I   6 96  0.0100  0.0000                 011
4                                                                                 012
4                                                                                 013
4                                                                                 014
4                                                                                 015
4                                                                                 016
4                                                                                 017
4                                                                                 018
4                                                                                 019
4                                                                                 020
4                                                                                 021
4                                                                                 022
4                                                                                 023
4                                                                                 024
```

Figure 87. The Data Cycle Definition Record *defines the contents and format of the user-defined part of the data cycle records, i.e. the last 1900 characters of each data cycle record. A complete list of the parameter codes used in the Øresund Data Bank is given in Appendix A.*

```
67 OERESUND269RNL            DENMARK   RISOE NAT. LAB.861126154014          022001
614MET-MAST9                         SJAELSMARK          198405150010198406150000002
6                                                                            003
6198406040010  198406060000  555268N 122527E100  -30099999999999999999999999004
6999999999999999999999999999999999999   NAME/0103KAL999999          0       0005
6                                                                            006
6                                                                            007
6                                                                            008
6                                                                            009
6                                                                            010
6                                                                            011
6                                                                            012
6                                                                            013
6                                                                            014
6                                                                            015
6                                                                            016
6                                                                            017
6                                                                            018
6                                                                            019
6                                                                            020
6                                                                            021
6                                                                            022
6                                                                            023
6                                                                            024
```

Figure 88. Data files contain one or more data series, each beginning with a mandatory Series Header Record. *This record is built exactly like the File Header Record, but contains information that is common to the series as a whole.*

77 46 0 1

395	498	89	146	146	9	84	100985	422	539	85	147	146	9	84	100985
445	576	86	147	146	9	84	100985	438	562	90	146	146	9	84	100985
461	592	96	147	146	9	85	100985	459	582	95	145	146	14	86	100971
475	609	95	145	145	9	86	100956	456	592	103	145	145	9	88	100956
472	599	90	144	144	4	89	100956	468	602	96	144	144	9	90	100956
461	595	98	144	143	4	91	100956	519	643	96	143	143	4	92	100956
449	565	74	143	142	4	93	100956	405	516	92	143	143	9	93	100896
449	572	97	145	145	4	93	100896	445	552	94	146	145	4	93	100896
486	606	83	147	146	4	94	100882	452	572	89	147	146	4	94	100882
472	582	97	147	147	9	94	100882	431	562	96	147	147	9	94	100882
452	579	91	149	149	9	93	100882	475	592	100	149	149	9	93	100882
482	609	91	149	149	4	92	100867	558	706	85	150	150	4	91	100837
472	599	92	149	149	4	91	100837	442	565	93	150	150	4	91	100837
465	579	95	151	150	4	91	100807	486	609	101	153	153	4	91	100807
456	576	85	155	154	0	89	100807	558	683	101	158	157	-5	87	100778
475	595	95	159	158	-5	86	100778	482	609	85	161	160	-5	85	100778
512	669	78	162	161	0	84	100763	502	632	80	163	162	-5	84	100763
468	595	89	164	163	-5	83	100763	479	595	89	165	163	-5	82	100763
572	722	93	166	164	-5	82	100763	482	616	101	166	165	-5	82	100763
498	629	98	167	166	-5	81	100763	479	609	98	169	167	-5	80	100763
482	592	92	171	169	-10	79	100763	459	552	90	173	171	-10	78	100763
452	576	95	175	173	-15	77	100763	449	549	88	177	174	-15	77	100763
495	619	85	177	175	-15	77	100763	438	556	94	178	176	-15	76	100763

Figure 89. The Data Cycle Record *is used to store the actual data in a format described in the Data Cycle Definition Record. The first 20 characters of each record contain accounting information for reading the data cycles from the tape, see Fig. 90.*

77 46 46 2

428	522	105	182	179	-20	74	100763	489	612	100	185	183	-30	72	100763
405	489	94	192	187	-30	70	100763	482	586	90	191	187	-35	70	100763
509	639	113	192	188	-25	69	100763	465	569	92	194	191	-35	69	100748
442	539	87	199	194	-45	68	100748	445	558	95	201	196	-45	67	100748
552	679	104	198	195	-35	67	100733	572	713	105	202	198	-35	67	100733
625	773	90	203	200	-30	66	100733	495	616	84	207	203	-50	65	100733
622	793	83	203	200	-40	65	100733	576	719	91	206	203	-45	66	100733
579	719	97	207	203	-40	64	100733	565	699	87	209	205	-45	64	100733
589	739	97	211	207	-40	64	100733	562	716	109	213	207	-45	63	100718
659	829	105	211	205	-50	62	100733	662	847	83	210	206	-40	63	100733
669	856	108	211	205	-45	63	100718	683	849	93	211	207	-40	62	100718
676	840	89	215	210	-45	61	100733	692	873	99	214	209	-40	61	100733
679	856	80	211	207	-45	61	100718	689	880	110	214	210	-45	61	100718
676	840	99	217	211	-50	61	100703	722	903	105	213	208	-50	61	100703
709	883	92	213	208	-45	60	100703	696	873	79	215	210	-45	60	100703
659	810	93	209	203	-50	61	100689	683	863	89	206	203	-50	61	100689
612	776	68	211	205	-50	61	100689	696	860	102	207	203	-35	62	100674
599	739	98	210	205	-55	62	100689	669	826	88	208	204	-40	62	100689
612	763	99	211	205	-50	61	100674	679	849	96	207	204	-30	61	100659
703	880	92	207	203	-40	61	100659	666	836	83	205	202	-40	62	100659
586	739	104	208	205	-40	61	100659	592	722	99	209	204	-40	62	100659
556	703	94	197	194	-25	63	100659	602	759	96	198	195	-25	63	100659
576	722	74	194	192	-20	64	100659	655	813	91	191	189	-15	64	100644

Figure 90. The second Data Cycle Record *in the file. Reading the first 20 characters in the record provides the following information: The record ID is 7, the next record is also a data cycle record (ID = 7), there are 46 data cycles or scans in the record, the total number of data cycles preceeding this record is 46, and the data cycle record count is 2.*

C Distribution and further information

The Øresund Experiment Data Bank is available from Risø National Laboratory and consists of the following items:

1. One 3600-ft, 1600-bpi magnetic tape in GF-3.2 format containing the complete data set, less the fast scanning (1 Hz) turbulence measurements – but including turbulence statistics derived from these. This tape constitutes the data bank proper.
   Other tape characteristics are: unlabelled, 9 tracks, odd parity. The character code is ASCII or EBCDIC according to the recipients wish. The tape density can also be 6250 bpi if so wished.

2. One 600-ft, 1600-bpi magnetic tape containing *Fortran* programs to process GF-3 tapes in general and the Øresund Data Bank in particular. These programs may also be furnished on a $5\frac{1}{4}''$ or $3\frac{1}{2}''$ floppy disk for use with a DOS PC.

3. Written documentation on GF-3 and the data bank: a list of files on the tape and tape specifications; an introductory guide to the GF-3 formatting system; a copy of the *GF-3 Reference Sheets*; a copy of the *GF-3 Technical Specification*; an Øresund Experiment Data Bank report; and documentation of the tape inspection utilities.

4. Three 3600-ft, 1600-bpi magnetic tapes containing the original turbulence measurements (1 Hz and 0.1 Hz), also in the GF-3.2 format. These tapes constitute separate data bank tapes and are only available upon request to Risø National Laboratory.

Correspondence concerning the Øresund Data Bank should be adressed to:

Risø National Laboratory
Department of Meteorology and Wind Energy
P.O. Box 49
DK–4000 Roskilde
Denmark

Phone: +45 42 37 12 12
Telex: 43 116 risoe dk
Telefax: +45 42 37 01 15 or +45 42 36 06 09

Up-to-date information on the GF-3 General Magnetic Tape Format and the format documentation listed in Section 6 can be obtained by writing to:

RNODC – Formats
Service Hydrographique
International Council for the Exploration of the Sea
Palægade 2–4
DK–1261 Copenhagen K
Denmark

D Sample Fortran program

The *Fortran 77* program listed below provides an example of how to actually work with the data bank, i.e. extracting data and information from the GF-3 files. To keep the program as simple and transparent to the user as possible, it was written specifically to process that sub-set of GF-3.2 used for the Øresund Data Bank. Consequently, it will *not* succesfully process any GF-3 formatted file. The documentation of the program is not extensive; however, by consulting the *GF-3 Reference Sheets* (Intergovernmental Oceanographic Commission, 1987) one should get acquainted with it quite fast. The program is available from Risø National Laboratory, see Appendix C.

```
C     TITLE:    GFUTIL/READFILE
C
C     AUTHOR:   N.G. MORTENSEN, RISOE NATIONAL LABORATORY, DENMARK.
C
C     PURPOSE:  READING AND DECODING A GF-3 FILE IN
C               THE OERESUND EXPERIMENT DATA BANK.
C
C     VERSION:  1.0 F77 - CORRESPONDING TO GF-3.2 - JULY 1986.
C
C     REFERENCE TO FORMAT IS THE IOC MANUALS AND GUIDES NO. 9, ANNEX 1,
C     PARTS 1, 2 AND 3 - INCLUDING THE CONSOLIDATED LIST OF ADDENDA AND
C     CORRIGENDA TO THE TECHNICAL SPECIFICATION OF GF-3,  SEPTEMBER 1985
C     VERSION.
C     THE USER IS ADVISED TO CONSULT THE "GF-3 REFERENCE SHEETS" WHILE
C     WORKING WITH THIS PROGRAM. THESE SHEETS CONTAIN THE INFORMATION
C     NECESSARY TO GET ACQUAINTED WITH THE PROGRAM.
C     PLEASE NOTE THAT THE PROGRAM IS SPECIFICALLY DIRECTED TO THE
C     OERESUND DATA BANK AND WILL NOT SUCCESFULLY PROCESS ANY GF-3
C     FORMATTED FILE.
C
C
C.....COMPUTER DEPENDENT FILE SPECIFICATIONS:
C
FILE  1(KIND='DISK',FILETYPE=7)
FILE  2(KIND='DISK',UNITS='CHARACTERS')
FILE  3(KIND='DISK',UNITS='CHARACTERS',MAXRECSIZE=80,BLOCKSIZE=1920)
C
C.....START OF MAIN PROGRAM.
C
      INTEGER ISCAN(100)
      REAL    FSCAN(100)
      CHARACTER TYPE*1, FMT2*60, FMT3*60, FMT4*60, FMT*200,
     *   PCODE(100)*8, PNAME(100)*27, PMODE(100)*1,
     *   TXTHD*400, SERID*12, TXTPL*1920, SX*3,
     *   FLTYPE*1, FLNAME*72, SUFFIX*72, IDNAME*12,
     *   ANSWER*1
C
C.....COMMON BLOCKS FOR FILE/SERIES HEADER RECORDS:
C
      COMMON /HDTXT/ TXTHD, SERID
      COMMON /HDNUM/ IDHD, NXTHD, NUMBER, ISTRT,ISTOP, IFRST,ILAST, NSF
C
C.....COMMON BLOCKS FOR PLAIN LANGUAGE RECORDS:
C
      COMMON /PLTXT/ TXTPL
      COMMON /PLNUM/ IDPL, NXTPL, IDSTAT
C
C.....COMMON BLOCKS FOR DATA CYCLE DEFINITION RECORDS:
C
      COMMON /DFTXT/ TYPE, PCODE, PNAME, PMODE, FMT2, FMT3, FMT4
      COMMON /DFNUM/ IDDF, NXTDF, NHDP, NDCP, KODE,
     *               IDISCR(100), LENGTH(100), IDUMMY(100),
     *               SCALE1(100), SCALE2(100)
C
C.....COMMON BLOCKS FOR DATA CYCLE RECORDS:
C
      COMMON /RELDAT/ IDID, NEXT , K1   , K2   , K3  , FARR(1900)
```

```
      COMMON /DACYRE/ IDDC, NXTDC, NDCPR, NDCBR, NDCR, IARR(1900)
C
C.....READ NAMES OF FILES AND OPEN THEM:
C
      DATA LGF3 /1/, LOUT /2/, LTXT /3/
C
C     LGF3: UNIT 1 - INPUTFILE IN GF-3.2 FORMAT (OERESUND DB)
C     LOUT: UNIT 2 - OUTPUTFILE FOR DATA
C     LTXT: UNIT 3 - OUTPUTFILE FOR TEXTUAL INFORMATION
C
      CALL OPENFL(' INPUTFILE?' , LGF3)
      CALL OPENFL(' OUTPUTFILE - TEXT?', LTXT)
      CALL OPENFL(' OUTPUTFILE - DATA?', LOUT)
C
C.....READ/WRITE FILE HEADER RECORD:
C
      CALL READHD(LGF3)
      CALL WRITHD(LTXT)
      NXT = NXTHD
      NSIF = NSF
C
C.....READ/WRITE PLAIN LANGUAGE RECORD(S) (FILE LEVEL):
C
      DO 1, LOOP=1,100
         IF( NXT .EQ. 4 )GO TO 2
         CALL READPL(LGF3)
         CALL WRITPL(LTXT,LOOP)
         NXT = NXTPL
    1 CONTINUE
C
C.....READ/WRITE DATA CYCLE DEFINITION RECORD(S):
C
    2 CALL READDF(LGF3)
      CALL WRITDF(LTXT)
      NXT = NXTDF
C
C.....CONCATENATE FORTRAN FORMAT TO READ DATA CYCLE RECORD:
C
      FMT = '(2I1,I4,I9,I5,' // FMT2(2:60) // FMT3 // FMT4
C
C.....FOR EACH SERIES IN THE GF-3 FILE:
C
      DO 3, LOOP=1,NSIF
C
C........READ/WRITE THE SERIES HEADER RECORD:
C
         CALL READHD(LGF3)
         CALL WRITHD(LTXT)
C
C........AND THE ASSOCIATED DATA CYCLE RECORDS:
C
         DO 4, NDC=1,100000
C
C...........FIRST, READ ALL 1920 CHARACTERS:
C
            CALL READDC( LGF3, FMT, NDCP )
C
C...........THEN, CHANGE STORED NUMBERS TO PHYSICAL VALUES AND SPLIT
C...........DATA CYCLE RECORD INTO SINGLE DATA CYCLES:
C..............IARR AND FARR CONTAINS THE ENTIRE DATA CYCLE RECORD
C..............ISCAN AND FSCAN CONTAINS SINGLE DATA CYCLES (SCANS)
C
            DO 5, I=1,NDCPR
               N = NDCP*(I-1)
               DO 6, J=1,NDCP
                  FARR(N+J) = FLOAT(IARR(N+J))*SCALE1(J) + SCALE2(J)
                  FSCAN(J) = FARR(N+J)
    6          CONTINUE
C
C..............AT THIS POINT THE DATA CYCLE RECORD HAS BEEN DIVIDED INTO
C..............SINGLE DATA CYCLES OR SCANS. THE FIRST NDCP ELEMENTS OF
C..............ARRAY FSCAN CONTAINS ONE SINGLE DATA CYCLE - CORRESPON-
```

```
C..............DING TO THE GF-3 DEFINITION RECORD.
C..............AT "5 CONTINUE" THE NEXT SCAN IS PROCESSED.
C-------------------------------------------------------------------
C              IN THIS EXAMPLE SOME PARAMETERS ARE WRITTEN ON LOUT:
C
               WRITE(LOUT,290) FSCAN(1), FSCAN(3), FSCAN(NDCP)
  290          FORMAT(3(F10.2,','))
C
C
C
C-------------------------------------------------------------------
    5       CONTINUE
C
C...........NEXT RECORD IDENTIFIER DETERMINES ACTION:
C
            IF( NXTDC .EQ. 6 )THEN
               GO TO 3
            ELSE IF( NXTDC .EQ. 5 )THEN
               GO TO 99
            ELSE
               CONTINUE
            ENDIF
    4    CONTINUE
    3 CONTINUE
C
C.....CLOSE FILES:
C
   99 CLOSE(LGF3,DISP='KEEP')
      CLOSE(LOUT,DISP='CRUNCH')
      CLOSE(LTXT,DISP='CRUNCH')
C
      STOP
      END
```

Subroutines

```
C.....PLEASE NOTE THAT THE PRESENT VERSION OF THE SUBROUTINES WAS MADE
C.....SPECIFICALLY IN CONNECTION WITH THE OERESUND DATA BANK - AND WILL
C.....THUS NOT PROCESS ANY GF-3 FILE SUCCESSFULLY.
C
      SUBROUTINE READDF( IUNIT )
C
C.......'READDF' READS A GF-3 DATA CYCLE DEFINITION RECORD,
C.......AND STORES THE INFORMATION IN COMMON /DFTXT/ AND
C.......COMMON /DFNUM/. IF THE DEFINITION COVERS MORE THAN
C.......ONE RECORD (1920 CHRS), THEY ARE ALL PROCESSED.
C.......PLEASE NOTE THAT THE FIXED FORMAT OF THE SCALING
C.......FACTORS IS NOT A GF-3-STANDARD.
C
        CHARACTER TYPE*1, FMT2*60, FMT3*60, FMT4*60,
     *     PCODE(100)*8, PNAME(100)*27, PMODE(100)*1
        COMMON /DFTXT/ TYPE, PCODE, PNAME, PMODE, FMT2, FMT3, FMT4
        COMMON /DFNUM/ ID, NXT, NHDP, NDCP, KODE,
     *                 IDISCR(100), LENGTH(100), IDUMMY(100),
     *                 SCALE1(100), SCALE2(100)
C
C.......READ DEFINITION RECORD INFORMATION AND FORMAT:
C
        READ(IUNIT,100) ID, NXT, NHDP, NDCP, TYPE, KODE, FMT2
        READ(IUNIT,101) ID, FMT3
        READ(IUNIT,101) ID, FMT4
C
C.......CALCULATE NO. OF PARAMETERS AND READ FIRST RECORD:
C
        LMT = MIN( NHDP+NDCP, 21 )
C
        DO 1, I=1,LMT
           READ(IUNIT,110) ID, PCODE(I), IDISCR(I), PNAME(I), PMODE(I),
     *     LENGTH(I), IDUMMY(I), SCALE1(I), SCALE2(I)
    1   CONTINUE
C
        DO 4, I=LMT+1,21
           READ(IUNIT,101) ID
    4   CONTINUE
C
C.......MORE THAN 21 PARAMETERS ?
C
        DO 3, KOUNT=1,10
           IF( NXT .NE. 4 )GO TO 999
           READ(IUNIT,100) ID, NXT
           READ(IUNIT,101) ID
           READ(IUNIT,101) ID
           LMT1 = KOUNT*21 + 1
           LMT2 = MIN( (KOUNT+1)*21, NFHP+NDCP )
           LMT3 = (KOUNT+1)*21
           IF( NFHP+NDCP .LE. (KOUNT+1)*21 )NXT = 6
           DO 2, I=LMT1,LMT2
              READ(IUNIT,110)ID,PCODE(I),IDISCR(I),PNAME(I),PMODE(I),
     *        LENGTH(I), IDUMMY(I), SCALE1(I), SCALE2(I)
    2      CONTINUE
           DO 5, I=LMT2+1,LMT3
              READ(IUNIT,101) ID
    5      CONTINUE
    3   CONTINUE
  999   RETURN
  100   FORMAT(2I1,2I3,A1,I8,A60)
  101   FORMAT(I1,16X,A60)
  110   FORMAT(I1,1X,A8,I3,A27,A1,I4,I3,F8.4,F8.4)
      END
```

```
      SUBROUTINE WRITDF( IUNIT )
C
C.......'WRITDF' WRITES GF-3 DATA CYCLE DEFINITION RECORD(S)
C.......FROM THE INFORMATION STORED IN COMMON /DFTXT/ AND
C.......COMMON /DFNUM/
C.......PLEASE NOTE THAT THE FIXED FORMAT OF THE SCALING
C.......FACTORS IS NOT A GF-3-STANDARD.
C
        CHARACTER TYPE*1, FMT2*60, FMT3*60, FMT4*60,
     *     PCODE(100)*8, PNAME(100)*27, PMODE(100)*1
        COMMON /DFTXT/ TYPE, PCODE, PNAME, PMODE, FMT2, FMT3, FMT4
        COMMON /DFNUM/ ID, NXT, NHDP, NDCP, KODE,
     *                 IDISCR(100), LENGTH(100), IDUMMY(100),
     *                 SCALE1(100), SCALE2(100)
C
C.......CALCULATE NO. OF RECORDS:
C
        NRECS = INT( (NHDP+NDCP-1)/21 ) + 1
        IF( NRECS .GT. 1 )NXT = 4
C
C.......WRITE DEFINITION RECORD INFORMATION AND FORMAT:
C
        WRITE(IUNIT,100) ID, NXT, NHDP, NDCP, TYPE, FMT2, 1
        WRITE(IUNIT,101) ID, FMT3, 2
        WRITE(IUNIT,101) ID, FMT4, 3
C
C.......CALCULATE NO. OF PARAMETERS AND WRITE FIRST RECORD:
C
        LMT = MIN( NHDP+NDCP, 21 )
C
        DO 1, I=1,LMT
           WRITE(IUNIT,110) ID, PCODE(I), IDISCR(I), PNAME(I), PMODE(I),
     *     LENGTH(I), IDUMMY(I), SCALE1(I), SCALE2(I), I+3
    1   CONTINUE
C
        DO 4, I=LMT+1,21
           WRITE(IUNIT,106) ID, I+3
    4   CONTINUE
C
C.......MORE THAN 21 PARAMETERS ?
C
        DO 3, KOUNT=1,10
           IF( NXT .NE. 4 )GO TO 999
           IF( NFHP+NDCP .LE. (KOUNT+1)*21 )NXT = 6
           WRITE(IUNIT,105) ID, NXT, KOUNT*24 + 1
           WRITE(IUNIT,106) ID, KOUNT*24 + 2
           WRITE(IUNIT,106) ID, KOUNT*24 + 3
           LMT1 = KOUNT*21 + 1
           LMT2 = MIN( (KOUNT+1)*21, NFHP+NDCP )
           LMT3 = (KOUNT+1)*21
           DO 2, I=LMT1,LMT2
              WRITE(IUNIT,110) ID, PCODE(I), IDISCR(I), PNAME(I),
     *        PMODE(I), LENGTH(I), IDUMMY(I), SCALE1(I), SCALE2(I),
     *        I + 3*(KOUNT+1)
    2      CONTINUE
           DO 5, I=LMT2+1,LMT3
              WRITE(IUNIT,106) ID, I + 3*(KOUNT+1)
    5      CONTINUE
    3   CONTINUE
  999   RETURN
  100   FORMAT(2I1,2I3,A1,8X,A60,I3.3)
  101   FORMAT(I1,16X,A60,I3.3)
  110   FORMAT(I1,1X,A8,I3.0,A27,A1,I4,I3,F8.4,F8.4,13X,I3.3)
  105   FORMAT(2I1,75X,I3.3)
  106   FORMAT(I1,76X,I3.3)
      END
```

```
      SUBROUTINE READHD( IUNIT )
C
C.......'READHD' READS A GF-3 FILE OR SERIES HEADER RECORD,
C.......AND STORES THE INFORMATION IN COMMON /HDTXT/ AND
C.......COMMON /HDNUM/
C
        CHARACTER TEXT*400, IDENT*12
        COMMON /HDTXT/ TEXT, IDENT
        COMMON /HDNUM/ ID, NXT, NUMBER, KTIME, LTIME, MTIME, NTIME, NSF
C
C.......READ FIRST 5 LINES OF HEADER RECORD:
C
        READ(IUNIT,101,END=9)
     *                  ID, NXT, TEXT(003:065), NUMBER, TEXT(078:080)
        READ(IUNIT,102) ID, TEXT(082:133), MTIME, NTIME, TEXT(158:160)
        READ(IUNIT,103) ID, TEXT(162:240)
        READ(IUNIT,104) ID, KTIME, TEXT(254:255), LTIME, TEXT(268:320)
        READ(IUNIT,105) ID, TEXT(322:358), IDENT, NSF, TEXT(377:400)
C
C.......THE LAST 19 LINES OF THE HEADER RECORD ARE ALLWAYS BLANK -
C.......EXCEPT FOR IDENTIFICATION AND LINE NUMBERS - AND NEED
C.......THEREFORE NOT BE READ INTO COMMON /HD.../ (OERESUND DB ONLY)
C
        DO 1, I=6,24
           READ(IUNIT,102) ID
    1   CONTINUE
C
    9   RETURN
  101   FORMAT(2I1,A63,I12,A3)
  102   FORMAT(I1,A52,I12,I12,A3)
  103   FORMAT(I1,A79)
  104   FORMAT(I1,I12,A2,I12,A53)
  105   FORMAT(I1,A37,A12,I6,A24)
      END
C
C
      SUBROUTINE WRITHD( IUNIT )
C
C.......'WRITHD' WRITES GF-3 FILE/SERIES HEADER RECORD,
C.......FROM THE INFORMATION STORED IN COMMON /HDTXT/ AND
C.......COMMON /HDNUM/
C
        CHARACTER TEXT*400, IDENT*12
        COMMON /HDTXT/ TEXT, IDENT
        COMMON /HDNUM/ ID, NXT, NUMBER, KTIME, LTIME, MTIME, NTIME, NSF
C
C.......WRITE FIRST 5 LINES OF HEADER RECORD:
C
        WRITE(IUNIT,101) ID, NXT, TEXT(003:065), NUMBER, 1
        WRITE(IUNIT,102) ID, TEXT(082:133), MTIME, NTIME, 2
        WRITE(IUNIT,103) ID, TEXT(162:237), 3
        WRITE(IUNIT,104) ID, KTIME, TEXT(254:255), LTIME,
     *                       TEXT(268:317), 4
        WRITE(IUNIT,105) ID, TEXT(322:358), IDENT, NSF, TEXT(377:397), 5
C
C.......THE LAST 19 LINES OF THE HEADER RECORD ARE ALLWAYS BLANK -
C.......EXCEPT FOR IDENTIFICATION AND LINE NUMBERS - AND NO EXTRA
C.......INFORMATION IS NEEDED IN ORDER TO WRITE THIS PART (OERESUND
C.......DB ONLY):
C
        DO 1, I=6,24
           WRITE(IUNIT,110) ID, I
    1   CONTINUE
C
        RETURN
  101   FORMAT(2I1,A63,I12.3,I3.3)
  102   FORMAT(I1,A52,I12.0,I12.0,I3.3)
  103   FORMAT(I1,A76,I3.3)
  104   FORMAT(I1,I12.0,A2,I12.0,A50,I3.3)
  105   FORMAT(I1,A37,A12,I6,A21,I3.3)
  110   FORMAT(I1,76X,I3.3)
      END
```

```
      SUBROUTINE READPL( IUNIT )
C
C.......'READPL' READS ONE GF-3 PLAIN LANGUAGE RECORD,
C.......AND STORES THE INFORMATION IN COMMON /PLTXT/
C.......AND COMMON /PLNUM/
C
        CHARACTER TEXT*1920
        COMMON /PLTXT/ TEXT
        COMMON /PLNUM/ ID, NXT, IDSTAT
C
C.......READ FIRST LINE OF PLAIN LANGUAGE RECORD:
C
        READ(IUNIT,100) ID, NXT, TEXT(003:074), IDSTAT
C
C.......READ NEXT 23 LINES OF PLAIN LANGUAGE RECORD:
C
        DO 1, I=2,24
           N1 = (I-1)*80 + 2
           N2 = N1 + 75
           READ(IUNIT,110) TEXT(N1:N2)
    1   CONTINUE
C
        RETURN
  100   FORMAT(2I1,A72,I3)
  110   FORMAT(1X,A76)
      END
C
C
C
      SUBROUTINE WRITPL( IUNIT, NOPL )
C
C.......'WRITPL' WRITES ONE GF-3 PLAIN LANGUAGE RECORD,
C.......FROM THE INFORMATION STORED IN COMMON /PLTXT/
C.......AND COMMON /PLNUM/
C.......NOPL IS A CONSECUTIVE NUMBERING OF PLAIN LANGUAGE
C.......RECORDS IN ONE FILE.
C
        CHARACTER TEXT*1920
        COMMON /PLTXT/ TEXT
        COMMON /PLNUM/ ID, NXT, IDSTAT
C
C.......WRITE FIRST LINE OF PLAIN LANGUAGE RECORD:
C
        WRITE(IUNIT,100) ID, NXT, TEXT(003:074), (NOPL-1)*24 + 1
C
C.......WRITE NEXT 23 LINES OF PLAIN LANGUAGE RECORD:
C
        DO 1, I=2,24
           N1 = (I-1)*80 + 2
           N2 = N1 + 75
           WRITE(IUNIT,110) ID, TEXT(N1:N2), (NOPL-1)*24 + I
    1   CONTINUE
C
        RETURN
  100   FORMAT(2I1,A72,3X,I3.3)
  110   FORMAT(I1,A76,I3.3)
      END
```

```
      SUBROUTINE READDC( IUNIT, FMT, NDCP )
C
C.......'READDC' READS ONE GF-3 DATA CYCLE RECORD AND
C.......STORES THE INFORMATION IN COMMON /DACYRE/
C.......FMT IS THE CONCATENATED FORTRAN FORMAT
C.......NDCP IS THE NUMBER OF DATA CYCLE PARAMETERS
C
        CHARACTER GFRECD*1920, FMT*(*)
C
        COMMON /DACYRE/ IDDC, NXTDC, NDCPR, NDCBR, NOREC, IARR(1900)
C
C.......READ DATA CYCLE RECORD INTO GFRECD AS TEXT:
C
        READ(IUNIT,100) (GFRECD(I:I), I=1,1920)
  100   FORMAT(23(80A1,/),80A1)
C
C.......READ INFO AND DATA CYCLES FROM GFRECD WITH GIVEN FORMAT:
C
        READ(GFRECD,FMT) IDDC, NXTDC, NDCPR, NDCBR, NOREC,
     *                  ( IARR(I), I=1,NDCPR*NDCP)
C
        RETURN
      END
C
C
C
      SUBROUTINE OPENFL( STRING, IUNIT )
C
C.....'OPENFL' IS A COMPUTER AND USER SPECIFIC SUBROUTINE
C.....TO OPEN THE FILES OF THE PROGRAM. PLEASE CHANGE
C.....ACCORDING TO YOUR NEEDS.
C
      INTEGER RECSZ, BLKSZ
      CHARACTER FIL*40, FLNAME*40, STRING*(*), FRMT*72
C
C.....FIRST, READ THE FILENAME:
C
      WRITE(6,*) STRING
      READ(5,'(A40)') FIL
      LOC = INDEX( FIL, ' ' ) - 1
      FLNAME = FIL(1:LOC) // '.'
C
C.....UNIT 1 IS THE GF-3 FILE:
C
      IF( IUNIT .EQ. 1 )THEN
         OPEN( IUNIT, FILE=FLNAME, STATUS='OLD' )
C
C.....UNIT 2 IS THE DATA OUTPUT FILE:
C
      ELSE IF( IUNIT .EQ. 2 )THEN
         WRITE(6,*)' ENTER RECORDSIZE AND BLOCKSIZE FOR OUTPUT FILE'
         READ(5,*) RECSZ, BLKSZ
         OPEN( IUNIT, FILE=FLNAME, STATUS='NEW', RECL=RECSZ,
     *         BLOCKSIZE=BLKSZ )
C
C.....UNIT 3 IS THE TEXT OUTPUT FILE:
C
      ELSE IF( IUNIT .EQ. 3)THEN
         OPEN( IUNIT, FILE=FLNAME, STATUS='NEW' )
      ENDIF
      RETURN
      END
```

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Abstract (Max. 2000 char.)

The present report supplements and extends a previously published magnetic tape containing the complete documented data set of the Øresund Experiment (Gryning, Bull. Amer. Meteor. Soc., 66(1985), 1403-1407). The report and the tape together constitute the *Øresund Experiment Data Bank.*
The report contains information not readily mapped into the data bank formatting scheme (GF-3), e.g. weather maps from each day of the experiment and satellite images from days with tracer experiments. Furthermore, the report presents an overview of the Øresund Experiment in tables and graphs, and in this way also serves as a key to the data bank. The general meteorological conditions during the experiment are revealed through time-series plots of selected meteorological parameters. Displaced-profiles plots of sodar-measured wind speeds and radiosonde potential temperatures give evidence on the structure of the atmospheric boundary layer. Finally, each of the 9 tracer experiments is illustrated by a map of the experimental set-up and graphs of the tracer concentration profiles measured along chains of ground-based stations.
In addition to the meteorological information the report provides an introduction to the GF-3 formatting system and summarizes the conventions applied in compiling the data bank. An overview of the contents of the data bank tape is also given.

Descriptors INIS/EDB

ACOUSTIC RADAR; AIRCRAFT; ANEMOMETERS; ATMOSPHERIC CIRCULATION; ATMOSPHERIC PRESSURE; BALLOONS; COASTAL REGIONS; COASTAL WATERS; DATA COMPILATION; DENMARK; DISPERSIONS; EARTH ATMOSPHERE; EXPERIMENTAL DATA; G CODES; HUMIDITY; METEOROLOGY; PLUMES; PRESSURE MEASUREMENT; RADIATIONS; RADIOMETERS; SWEDEN; TEMPERATURE MEASUREMENT; THERMOMETERS; TURBULENCE; VANES; WEATHER; WIND.

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